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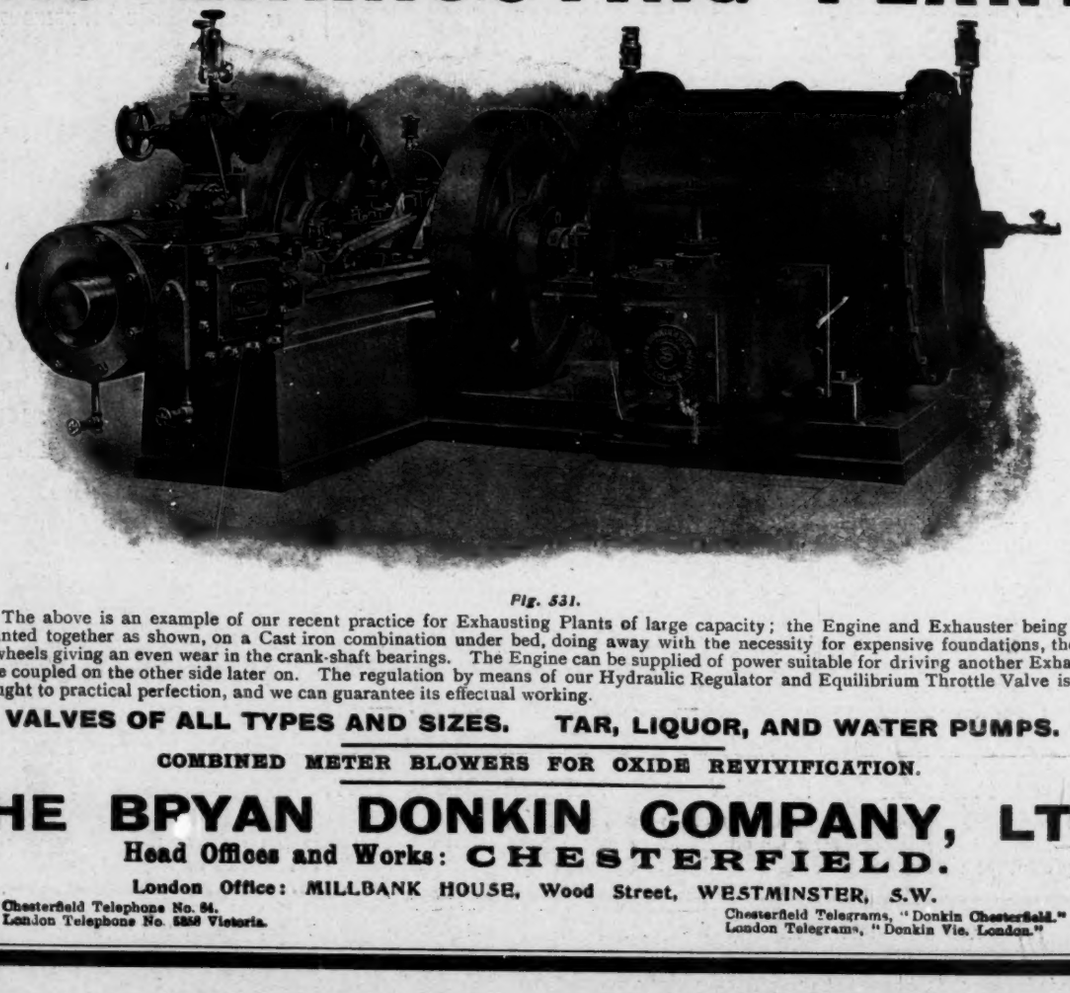

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EDITORIAL NOTES.

War Lighting Economies and Restrictions.

THE official exhortation to private individuals not to waste coal, gas, or electricity and the lighting restrictions in London streets were the subjects of some criticism at the meeting of the Illuminating Engineering Society last Friday. In these matters, the authorities have gone altogether the wrong way to work, which seems to have been a fatal propensity throughout their doings in the war. But they are learning by experience; and some of the experience has been dearly paid for. Taking first the question of public lighting restrictions. Mr. Leon Gaster, who introduced it for discussion, illustrated how the number of street accidents in the Metropolitan area had been increasing during the war, notwithstanding the lessened vehicular and foot traffic in the streets at night time, and the additional care exercised by pedestrians in the dark. And it is very dark from the afternoon through the long night in the London streets just now when the moon does not vouchsafe some relief. It is to be earnestly hoped that the rumours afloat that there are good prospects of some improvement being afforded, are true. Darkening of the streets is the proper thing as a protection against enemy airships and bombs; but method and time in relation to the darkening are also points to be considered. The methods adopted of obscuring globes and lanterns are crude, unscientific, and uneconomical. They were, however, the most available emergency expedients; but they ought to have been regarded as only temporary. Instead, they were applied, and left; and only latterly has there been any indication that attempts are being made to dispel some of the crudity by trying to effect a better distribution of the small volume of light that is permitted to escape from high-power lamps.

There is no doubt now that the matter should not have been left in the primitive state with developments along the same lines; but there ought to have been a proper investigation by qualified persons to see what better could be done. It is not as though there were any very great saving being effected. What saving there may be is altogether out of proportion to the inconvenience and public danger involved; and it is a moot question as to whether safety from the attentions of aircraft could not in London be effected in another way. In most of the lamps alight with their obscured glass, the same quantity of gas and electricity is still being expended, in order to obtain the little glimmer which marks the situation of lamp columns and nothing else, and which is all that can find its way through the surrounding opacity. It does seem a pity that, if possible, this expenditure of gas and electricity should not be used in making the streets more tolerable, and without really affecting safety in respect of aircraft. And it is a question whether continuous darkness is now essential for public protection against the German cowards who creep high up and under cover of night on their mission of murdering civilians—men, women, and children—and destroying their homes. It must also be remembered that, since the first of these visits, our defences against enemy airships have become better and better organized, including the system whereby intelligence is received of the approach of the raiders. This being so, would it not be possible to give the public the advantage of more light in at any rate the busy central areas, and for the extinguishing of the lamps being arranged for on notification being received from the authorities? With gas-lamps, this could already well be done by the pressure-wave system where the lamps are equipped for lighting and extinguishing by this means. With aerial craft taking part in warfare, and with the demonstrated advantages of darkened streets as a protection against their mischievous intentions, provision for prompt extinction and lighting of lamps has become of military importance. And this provision should in future take the place of the primitive plans that have had to do service through unpreparedness during the present war. Mr. Gaster suggested that it was high time some central authority was appointed to deal with the matter of public lighting in war time, and to bring about greater uniformity in the protective measures adopted in London, and possibly throughout the country. The advisability depends on the constitution of the central authority. Given a proper constitution, we agree. In addition to "uniformity," we should like to see the question treated from the point of view of the changed conditions, which give greater scope to commonsense and scientific treatment.

The official injunction not to waste coal, gas, or electricity, which, with callons indifference, stares at us from the hoarding, and fails to impress as to its true purpose, has done, or can or will do, very little in the promotion of economy in these directions. "Waste" is something in excess of requirement; and the accounts of domestic gas consumers do not suggest that, generally speaking, the consumption is in excess of need. The raw and cold days, and the outer darkness, also tend to obliterate from the mind the exhortation of the hoarding. This exhortation, if it is to be at all effective where opportunity exists, wants supplementing by authoritative advice as to what can and should be done. And, again, there is not the slightest use sending out an absurd general request that consumption for lighting should be reduced by 10 per cent. There is not room for such a universal reduction, even were there practical means for seeing that it was made. The authorities should take counsel with those who know of these things, and not try experimental notions which only invite ridicule. Above all, it should be borne in mind by them that the supplies of high explosives can be enlarged or reduced by the increase or decrease of gas consumption.

Coalite Critics and Anticipated Success.

OPTIMISM continues to be the feature of the speeches from the Directors' side of the table at meetings of the British Coalite Company. We once published an article from an esteemed correspondent, on "Optimism as a Tangible Busi-"ness Factor;" this "tangible business factor" has been possessed to a degree in Coalite affairs that has not been beneficial for the old shareholders. After weary years of waiting, they would like something more tangible than optimism. Men have come and men have gone from the Board of Directors of the Company. But, with the ever-changing *personnel*, there has been (the same figure has been continuously at the back of the Board) an unbroken tale of brilliant prospects, although current conditions were unproductive for the shareholders. It was the duty of the Chairman (Mr. W. J. Fisher) to explain to the shareholders last Tuesday the causes of delay in the completion of the Barnsley Smokeless Fuel Company's plant. Foundations, plant production and delivery, the making of special fire-clay bricks, and the difficulty of obtaining suitable workmen, are the assigned causes. We have no reason to dispute them; they are difficulties everywhere in the gas industry. But Mr. Fisher carried on the tale of optimism; so much so that he allowed it to run away with him in administering a little weak rebuke to those who had dared to criticize the "virtues" in relation to commercial prospects of low-temperature carbonization in comparison with those of high-temperature carbonization—bearing in mind that the gas industry (perhaps Mr. Fisher is not conversant with its technical history) started its career with low-temperature carbonization, and in its commercial interests worked-up to high temperature with new methods. The Chairman also referred to the Coalite Company as having been for many years a pioneer in low-temperature carbonization—the gas industry was a "pioneer" in it long before the Coalite Company, whose "pioneering" work has not so far been very profitable.

Where Mr. Fisher showed a little irritation was when stating that the work of the Company is being watched

attentively—indeed, jealously—by the interests engaged in the high-temperature carbonization of coal; and he thinks that a little suspense of judgment would have had the effect of saving them from proving "false prophets" when the Barnsley plant showed itself the success that the Directors anticipated. Anticipation is not realization, as the history of the Coalite Company proves. In connection with it, there have been a good many "false prophets;" and, up to the present, the critics have not been very far out of their reckoning—judging by the commercial results achieved. Real success must find its embodiment in commercial results. There are admittedly certain technical advantages in low-temperature carbonization; there are others in high-temperature carbonization. But all enterprise must stand or fall by the financial issue of the working and trading. Mr. Fisher also took another "line" in attempting to inspirit the shareholders. He stated that interesting discussions on fuel economy took place at the meeting of the British Association last September, the general sense of which was that, if the nation was to derive full benefit from its wealth in bituminous coal, this would have to be carbonized at low temperatures—thus effecting an enormous saving in the great national asset. Who were the men who said this at the British Association meeting? Were they men who had had practical experience of low-temperature carbonization and the products, men who had investigated the question as to the need to use coal rich in volatile matter in order to get the best possible return in light oils, and men who had studied the possibilities in respect of market values—not only now, but after the war—and therefore of profit realization? Was Professor Armstrong—idealist, self-appointed champion of low-temperature carbonization, and amusing critic of the gas industry—one of these men? It happens that Professor Bone, the Chairman of the Fuel Economy Committee of the British Association, has spoken elsewhere on this subject. He is not by any means antagonistic to low-temperature carbonization—rather the contrary. But he is not convinced that the processes have advanced beyond the early stages of technical development. He said this in his Royal Institution lectures early in the year; he said the same thing the other day at Cardiff. On the latter occasion, too, he made it quite clear that, though he thought there were possibilities in low-temperature carbonization, he should not like to speak with any certainty as to what were likely to be the commercial results—in fact, he did not think they were yet in a position to warrant them making a recommendation that this system of distilling coal should be adopted. On both occasions, he also suggested that the Government should have the prospects investigated by disinterested experts. That is not quite the same thing as the happy view Mr. Fisher took of the British Association discussions, when the opinions of practical coal carbonizers were conspicuous by their almost entire absence.

Producer Economy.

When fuel economy is so much a subject of the hour, and when a more economical fuel expenditure in existing plants is a result of more efficient methods of working, all discussion that directs to higher efficiency and economy is of interest and of value. It was so in the case of the paper on the "Control of Gas-Producers" that Mr. J. A. C. Edmiston, of Motherwell, read at the last meeting of the Scottish Junior Gas Association (Western District). Gas-works are considerable users of fuel for heating purposes, in producers independent, or forming an integral part, of the carbonizing plant. From the thermal standpoint, gas-works carbonizing plant is not very efficient—in some cases, it is more inefficient than in others, as witness the fuel accounts. An important point in heating efficiency is to secure uniformity of the producer gas; but considering the variable producer conditions, there cannot be that exactitude in composition which would be the ideal condition. The best attainable conditions cannot, however, be secured by happy-go-lucky working; there must be supervision. If more money were spent on competent chemical supervision on many gas and other works, there would be less waste and less disuniformity in manufacturing results, and therefore greater economy.

The methods of producer control adopted by Mr. Edmiston are described by him; but he does not practise an over-all scientific control. Both rule-of-thumb and rule-of-eye partly enter into his methods of control. He shows pretty conclusively that the chemical analysis of cooled gas is no reliable test as to the composition, and therefore the value, of the gas in the furnace to be heated. Particularly does this apply to producer gas from bituminous coals, owing to only a small proportion of the hydrocarbons being converted into fixed gas—the remainder being evolved as tarry vapours, and passing forward as such into the furnace. He therefore seeks control in other directions. It is a fine working ideal that a continuous record of the calorific intensity in the furnace should be kept, and the manipulation of the producer be co-related to this. The ideal is easier framed in mind than given effect to in practice, though (where there is adequate supervision in the matter of furnace regulation) furnace temperatures, of course, provide an excellent check upon the consistency of producer operation within the possible limits. Mr. Edmiston employs a carbon dioxide recorder of a very simple type. Passing from scientific control, he, in the recording of fuel-bed temperatures, relies, and therefore we take it recommends others to do the same, upon the discriminating power of his eyes. There are eyes and eyes; there are good capacities for judgment, and there are bad ones. Just as some men have excellent capacity for judging lengths, heights, and other measurements of mass or space, so others may be good judges of temperatures. But there are many whose ability does not lie in such directions. Besides temperatures are very deceptive according to the light or otherwise under which they are examined. Where scientific control is being advocated, it is better, when possible, to have it all through, and not in part depending upon the vagaries of human manipulation and judgment. The sensible heat of the gas leaving the producer is measured; and the aqueous saturation is fixed by controlling the temperature of the air and aqueous vapour mixture passing to the fuel bed. A proper control of the temperature of saturation of the air has a good effect upon the prevention of the formation of clinker. Then, again, Mr. Edmiston does not believe in setting a regular time for clinkering, nor has he any friendly leaning whatever towards mechanical clinkering. To the bottom attendant he leaves the question of removing ash and clinker at the blower, though he admits a good deal of trouble has arisen in respect of poor gas results, through the work being irregularly done. While some ash or clinker should be left above the blower to preheat and assist decomposition of the aqueous vapour and air, if there is too much present back-pressure results, and lowers the amount of blast that passes through the producer.

Depth of fuel in the producer, regularity of charging and weight of charge, and removal of ash, must all contribute to the regularity of the gas supplied to the furnace. The weight of coal charged into the producer at one time should not be too heavy, in view of the sudden evolution of gas, which brings us to the question of automatic regulation of the air supply to furnaces. The sudden evolution of gas does not admit under hand control of the admission of the right proportion of air to the furnaces; for the dampers cannot possibly be regulated every time the producer is charged. Therefore, says Mr. Edmiston, under hand control, there may be (a stronger word than "may" might well be used) an excess of gas in the furnace which would go up the chimney unburned. It follows that, if the air supply were sufficient for the combustion of the gas at that stage, there would be a deficiency in the intervening periods. This points to more consistent working conditions being found in automatic air-supply regulation. But upon this Mr. John Frazer, of Dalmarnock, states that he has seen an experiment tried of regulating the air supply which had disastrous results. Birmingham has had a large and a long experience with the Brooke system of automatic air regulation to retort-furnaces; and the consequences, instead of being disastrous have resulted in considerable fuel economy. More will be heard of this automatic regulation of air supply to variable furnace conditions in the fuel economy campaign that is now proceeding.

While Mr. Edmiston does not practise automatic air regulation, he operates with the view to keeping producer conditions as nearly uniform as working will admit, in order to secure as approximate constancy in gas yield as possible; and whatever may be the criticisms levelled against him in part of his work, he does obtain, given systematic working on the part of the producer men, gas of fairly uniform composition. The methods he employs are not new; but he has systematized them to suit his own views and working. There is agreement with Mr. John Wilson, of Greenock, that it is a great mistake to design a plant (as suggested by

Mr. Edmiston) for use with any particular coal. It puts upon it an undesirable limitation from more than one point of view. The author submitted, as one reason for his suggestion, that a good many works draw their coal supplies from one pit. Supplies from one pit have been known to vary considerably in quality; and there are gas engineers who have had bad experiences of the inconsistencies of coal reputed to have been derived from the same pit. Such experiences have been unpleasantly frequent just lately.

The Opportunity of Australia.

THE war is in a remarkable manner shuffling the economic conditions of the world, and is distributing fresh opportunities in remote quarters, which, if advantage is taken of them, will materially reduce concentration and promote devolution. Concentration in manufacture and trade in many lines was, before the war, largely occurring to the benefit of certain countries; others were accepting their dependence upon them as amatter of course. The war intervened. The ordinary course of manufacture and trade was interrupted by the requirements of the war; and shipping that was not engaged on war work, or that retained (which enemy shipping did not) the liberty of the seas, was largely required for the transport of necessaries. Thus the remote countries were left without much of the incoming manufactured goods to which they had been accustomed; and to supply as far as possible the deficiency, they were left to their own resources. Just as the best that is in a man shows itself when thrown upon his own resources, so is the best that is in a country developed when stern necessity compels. Until the war came, there is certainty that Australia did not know its own potentiality. But it is surely finding it out by degrees; and the future will see that the European war (in which Australia has rendered such invaluable aid to the Motherland) marks an epoch in the economic history of that country.

The short Presidential Address that Mr. R. J. Lukey, the Secretary of the Australian Gas Company, delivered at the meeting of the New South Wales and Queensland Gas Institute is largely indicative of this; and it shows, too, that the gas industry will be advantaged by the manufacturing power, now in the nascent stage, which is making itself felt, and which will and must develop—the start having disclosed and proved capacity. The consumption of gas in Australia is steadily on the increase, and residuals are promised better markets. These movements, Mr. Lukey tells us, are chiefly owing to the increased activity in industries engaged on the production of materials to take the place of those previously imported from other countries. The words are few; the possibility they disclose is enormous. For goods, large and small, that formerly reached Australia from this and other countries, the future may see Australia itself competing for trade in the outer world. It has the men, the brains, and supplies of materials of various kinds; as well as large fundamental industries from which to supply money wherewith to strike out into new lines, and to develop. Our makers of gas plant and appliances will note that with the growth of gas consumption in Australia —a growth that Mr. Lukey states has placed some gas companies in the happy position of having (we hope he has not made a mistake) attained the unique and ideal load of a uniform rate during the whole twenty-four hours—there has been the impossibility of securing due supplies of plant, &c., from the old country. What has happened? The want and the impossiblity of satisfying it from abroad has "stimulated the power of resource and quickened the in-"ventive faculties;" and a beginning has been made in directions hitherto not attempted in meeting the needs of the industry. One never knows what can be done until trial is made. One cannot tell positively to what all this ultimately tends; but, where there are resourceful and inventive men, one can make a shrewd guess. It is only the natural order of things. Australia, Mr. Lukey tells us, has taken a great and successful step towards becoming a manufacturing nation; and plant of all descriptions is now being produced there which formerly would have been considered impossible. Australia has been a good patron of the gas-plant makers of the home country—a patronage capped by a 12 million cubic feet holder for the Australian Gas Company, and such modern plant as vertical retorts and telphers in Sydney and in other places. Manufacturing revolutions do not occur in a day. Our business relations with the Australian gas undertakings will continue far into the future; and perhaps upon a greater scale, seeing that any installation of German plant and goods will only be memorials to the infernal methods adopted by the Germans in the conduct of the war, and will not be tolerated. But Australia has made a beginning in new manufacturing enterprises. Where will it end? Wherever it may be, there will be no envy displayed in the Mother Country; but there will be gratification and rejoicing over the additional prosperity of one of her children.

Professor Armstrong again Speaks.

Since Professor H. E. Armstrong has taken to speaking of the claims of low-temperature carbonization, he has become quite a ubiquitous person. He appeared at the University College, Nottingham, on Monday of last week, and told the old tale; once again charging the gas engineer with things of which he is quite innocent, accusing him of being saturated with the prejudices of past generations, and with being a man of only one object in life —the making of the maximum volume of gas per ton of coal. Whatever the gas engineer may think of himself, his technical work, and commercial enterprise, he is obviously in the mind of Professor Armstrong something with an intelligence very much inferior to their critic's own. He it is who knows where they are wrong; he it is who can assuredly put them right. "I have always myself advocated the supply of a rich rather than of a poor gas." Because "I" so advocate is surely no reason why "I" should be right. Professor Armstrong would send to the houses of the consumers a gas which would blacken their ceilings, through improper combustion due to the difficulty of thorough aëration of the rich gas. At the same time, the Professor got so far off his pedestal as to admit that, until gas-heating apparatus has been more developed, and the whole subject placed upon a proper scientific basis, it will be premature to come to any final conclusion with regard to the quality of the supply that is most desirable. Nevertheless, he says the policy of lowering rather than raising the quality of the gas will have to be reconsidered, in view of the fact that the cost to producer and consumer as well as the dimensions of the necessary mains, vary inversely rather than directly with the quality. It would be of advantage if the Professor would enter into a little more detail as to his meaning, inasmuch as it is a trifle obscure looked at in the light of practical knowledge. Take, for instance, the reference to dimensions of mains. Apparently the Professor knows little of pressure in relation to current practice and use, and of the fact that the lower qualities of gas are more amenable than the richer qualities to the higher pressures, owing to the latter having a tendency to get rid under the higher pressure of a portion of those very hydrocarbons which impart to the gas the richness which the Professor advocates, though he admits that any final conclusion on quality would be premature.

Trade after the War.

The circumstances which will affect the foreign trade of this country on the conclusion of peace, and the preparations necessary to meet the new situation, have been considered by the Federation of British Industries, who, as the result, have drawn up a list of practical recommendations for the attention of the Government. Taking it for granted that economic conditions after the war—and more particularly those which will exist in belligerent countries—will greatly increase the severity of the competition in foreign markets, just when it will be vitally necessary for British productions to secure a greatly increased sale in these markets, the Federation draw attention to the heavy responsibility which will be thrown upon the Government commercial service, and especially those departments and services charged with the promotion of foreign trade and with the collection and distribution of foreign commercial intelligence. They are convinced that these responsibilities are of such a nature that the duties, character, and scope of the departments and services concerned will require radical re-organization, and considerable extension; and, without in any way attempting to lay down detail reforms, they have, therefore, suggested certain broad principles which, they consider are essential to any successful re-organization. Among the recommendations is one that, in order to supply the requisite detailed and expert knowledge of local industrial and commercial conditions, and to secure the necessary continuity of local commercial policy, the

present Commercial Attaché should be replaced by an officer of high rank attached to every Embassy and Legation, who might be entitled the Commercial Counsellor. There are other points as important, which cannot be dealt with here. No doubt, however, Mr. R. T. Nugent, Director and Secretary of the Federation, would forward a copy of the recommendations to any reader applying to him at No. 51, Lincoln's Inn Fields, W.C. The gas industry is already directly assisting in forwarding the aims of the Federation; for we notice in the long list of influential members, among many familiar names, that of the South Metropolitan Gas Company.

Coal and Coke Exports and Values.

The Board of Trade returns for November disclose that this country is doing a remarkably paying business in coal for export, in that, though the quantity is about half that sold abroad in November, 1913, the total value only falls short of that of the latter by a little under 6 per cent., while, though a lower quantity was sent abroad last month than in the corresponding month of 1914 and 1915, the value has gone up very materially. To get to actual figures. In November, 1913, the coal exported amounted to 5,913,404 tons, of a value of £4,100,584; while last month the quantity exported was 2,998,052 tons of a value of £3,859,213—that is to say, though 2,915,352 tons less were sent abroad, the value was only £241,371 less. There has been a notable rise in value since November, 1914. In that month 3,280,160 tons of coal were sent abroad, of a total value of £2,156,698; while last month 282,108 tons less were shipped, but the value was no less than £1,702,515 more. In November, 1915, 3,302,771 tons of coal were exported, valued at £2,882,631. The quantity was greater than that shipped last month by 304,719 tons; but the value was less than that of last month by £976,582. The returns as to coke shipped are: 1913, 126,307 tons; 1914, 100,202 tons; 1915, 110,946 tons; 1916, 121,842 tons. Values were: 1913, £108,855; 1914, £75,742; 1915, £149,924; 1916, £235,323.

An Association of Manufacturers of Refractory Materials.

A resolution to the effect that a Refractory Material Section be formed in connection with the English Ceramic Society was unanimously agreed to at a meeting of manufacturers of refractory materials held in Manchester last Wednesday. Support by about sixty firms had been promised to the proposal to form an Association representative of the trade. Mr. Albert Cliff (of Messrs. Williamson Cliff, Limited, of Stamford), who was chosen to take the chair, remarked that the movement was initiated by gas engineers; and the gas people had all along given it generous and unfailing support. There was very great need of some such organization as was proposed. What they had to do was to consider whether they could usefully do anything to bring the chemists, users, and manufacturers into closer relation with each other; to arrange for the occasional discussion of refractories and the improvement of their manufacture; to standardize, as far as possible, shapes and sizes; and to discuss freight rates, and to generally promote and defend the interests of the trade as a whole. Major Thomas (of Messrs. E. J. & J. Pearson, Limited, of Stourbridge), who moved the resolution, spoke in high terms of the work being carried on at Stoke under Dr. J. W. Mellor. Secretaries were appointed to represent the new Society in the various manufacturing districts.

Prohibited Exports.—By an Order in Council dated last Tuesday, there have been added to the list of prohibited exports thorium and its alloys, zirconium and its alloys, and zirconium compounds.

Export of Coal to Italy.—The Secretary of the Coal Exports Committee announces that, in connection with the recent arrangements for the limitation of prices and freights for coal for Italy, it has been decided that on and after the 15th inst. all applications for licences to export coal, coke, and manufactured fuel to Italy (including Sicily, Sardinia, and Tripoli) must be made through the Local Committee of the district from which the shipment is to be made. In other respects, applications are to be made, and will be dealt with, in accordance with the existing rules and practice applying to all similar applications. The Local Committees for this purpose are the same as those for the supply of coal to France—suitable additions having been made to the membership. The importation of coal, coke, and manufactured fuel into Italy now being controlled by the Italian Government, exporters, before applying for licences to ship, should ascertain whether the necessary authorization for importation has been obtained by the consignees or buyers.

CALORIFIC STANDARD ACT APPLICATIONS.

Fourteenth Official List.

Applications have been received, by the Board of Trade and the Local Government Board respectively, for Orders for the following undertakings, fixing a calorific standard of 500 B.Th.U.

Petersfield and Selsey Gas Company.
Shipley Urban District Council.

PERSONAL.

Lance-Corporal James S. Shaw, who recently gained the Distinguished Conduct Medal for repairing telephone wires under heavy shell fire, and had to be taken to hospital suffering from shell shock, is now in a Sheffield hospital with wounds in the right arm and leg. He is the son of Mr. J. Shaw, the Manager of the Gas-Works at Shelley, near Huddersfield.

Included in a list of distinctions published in the "London Gazette" on Monday of last week, was the name of Second-Lieutenant R. Carr, R.E. (son of Mr. Isaac Carr, of Widnes), as having been awarded the Military Cross, for conspicuous and repeated gallant conduct during the Somme operations. The official record states that, under very heavy fire he collected his men, organized their work, and supervised it, with total disregard for his personal safety, until the consolidation of the position was completed. He repeatedly carried out work of the utmost value, and has shown the most conspicuous devotion to duty. Lieutenant Carr, who is 25 years of age, was at the outbreak of war Assistant Manager, under his brother, Captain W. M. Carr, at the Ormskirk Gas-Works. On the Captain's mobilization, he became Manager of the works. A third son in the army is Captain Jim Carr, who has been in France since the beginning of the present year.

On the 6th inst., Mr. W. H. Day, the Secretary of the Rochester, Chatham, and Gillingham Gas Company, celebrated the completion of fifty years' service with the Company. Half-a-century in one employ is something to be proud of; and the occasion was marked by a dinner which was served at the Gordon Hotel in the evening (at which Mr. C. Valon Bennett took the chair), when Mr. Day was the guest of the officials. During the evening, the Chairman of the Company (Alderman E. W. Willis, J.P.) made a presentation to Mr. Day of a grandfather clock, on behalf of the officials and also a case of pipes from the workmen of the distribution department. On Thursday last, at a meeting of the Directors, Mr. Day was presented by them with a silver salver for fifty years' faithful service. When Mr. Day started, he was coke clerk at Rochester, at the lowest rung of the ladder; in September, 1869, he was promoted to the head office; on Jan. 7, 1898, he was made Chief Clerk; and in 1913 he was promoted to Secretary in succession to the late Mr. J. M. Veevers.

OBITUARY.

WILLIAM KING.

The gas profession and many friends last Friday sustained a severe loss by the death, which we are sorry to have to record, at his residence, Beach Lawn, Waterloo, Liverpool, of Mr. William King, J.P., who was formerly for 37 years Engineer-in-Chief to the Liverpool United Gas Company, a position to which he succeeded, when 28 years old, on the death of his father in 1867. He retired in 1904, though the Directors still retained his services as Consulting Engineer. For close upon a century, the family name has been associated with the Liverpool Gas Company; for in 1818 his uncle, Mr. Joseph King, was appointed one of the first Directors of the original Company. Four years later he resigned this position, when his brother, Mr. John King, became Engineer. After the lapse of a further period of four years, he died; and another brother, Mr. Alfred King, succeeded him. Mr. William King was Mr. Alfred King's son. Having been born in 1839, Mr. William King had reached the age of 77 years at the time of his death. He was educated in Liverpool, and entered the Company's service in 1856; being trained under his father, whose Assistant he became in 1861.

On his retirement after close upon half-a-century's—48 years, to be exact—active service with the Company, he was presented with a handsome casket and an address bearing testimony to the high esteem in which he was held by the officials and workmen. The chair was occupied on that occasion by Mr. Edward Allen—now, unhappily, himself dead—who aptly remarked that the keynote of the meeting was their love for Mr. King. References in the "Journal" to our late friend's work have not been numerous for professionally, and as regarded the affairs of his Company, he was always very reserved. However, at the gathering now referred to, some figures quoted by him showed how great had been the progress made by the undertaking during his engineership. When he was appointed to the position, the make of gas in Liverpool was 1433 million cubic feet of gas per annum; while by 1904 the output had passed 4000 millions.

Mr. King was elected a member of the Institution of Civil

Engineers in 1874; and he was also a member, among other bodies, of the Institution of Mechanical Engineers, the Institution of Gas Engineers, and the Liverpool Engineering Society. He was Vice-President and a Trustee of the Institution of Gas Engineers on its formation in 1891—holding the latter office until the time of the amalgamation with the Gas Institute. He did some parliamentary work, and was a member of the Departmental Committee appointed in 1904 to inquire and report as to gas testing in the Metropolis. For some time he had been a Director of the Brentford Gas Company.

After ceasing active work with the Liverpool Gas Company, Mr. King travelled a good deal. As a matter of fact, the very year of his retirement he started with his wife on a voyage round the world; and they were absent from this country for something like eleven months.

The remains will be cremated to-day (Tuesday) at Anfield; the service being at St. John's Church, Waterloo, at two o'clock.

G. STANLEY COOPER.

We much regret to announce the death last Friday morning of Mr. G. Stanley Cooper, B.Sc., recently Manager of the bye-product coking plant of the Yorkshire Coking and Chemical Company, Limited, at Glass Houghton, Castleford, and formerly Chief Chemist of the Koppers Coke-Oven and Bye-Product Company, of Sheffield. He had been unable to do much practical work since May last, having suffered from a serious physical ailment.

Mr. Cooper was an honours graduate of London University, a Fellow of the Chemical Society, and a member of the Midland Institute of Mining and Mechanical Engineers, and was connected with several other technical and professional institutions. He had an extensive knowledge of the chemistry of fuels, and particularly of coal and the bye-products of carbonization, and often contributed articles to the "JOURNAL" and other technical organs. He also frequently took part in the proceedings of different Associations. He had spent some time in Germany, in the study of special methods of bye-product coking and the recovery and treatment of bye-products, and had visited, in the course of his experience, many Continental plants. Mr. Cooper, who was only 29 years of age, was a native of Cleckheaton. He leaves a widow, the younger daughter of Mr. and Mrs. Charles Atkinson, of Bradford.

AMERICAN COMMERCIAL GAS ASSOCIATION.

REPORTS which are coming to hand of the proceedings at the twelfth annual convention of the National Commercial Gas Association of America, agree that the meeting was an unqualified success. It was held at Atlantic City (N.J.), in the week commencing the 13th ult., and was accompanied by a practical exhibition of the newest and best appliances for the use of gas. More than 1200 members registered attendance at the convention.

The President was Mr. Jansen Haines, of Des Moines; and he delivered an address on "Ideals and Education." He maintained that there is just as much opportunity for idealism in commercial activities as there is in art, literature, or music. One of the difficulties which confront all big businesses, he said, is that of having things imperfectly done—the lack in individuals of appreciating the necessity for doing things correctly, of analyzing accurately situations that arise, and of giving clear expression in statements of such situations. One ideal should be to overcome this in daily work. Conscientious effort and education will do more than anything else to overcome such shortcomings. Realizing that education is the systematic development and cultivation of the normal powers of intellect, so as to render them more efficient in some particular form of endeavour, and that it is also the training resulting from a systematic pursuit of a complete course of learning, the Association have carefully prepared, and offer to the members at small cost, a suitable course, which is now nearing completion, and which will represent the investment of approximately $50,000—not including the tremendous amount of voluntary work that is put into the scheme. One of the most progressive companies have over 500 employees enrolled in these courses.

The address over, the election of office-bearers was taken in hand. The new President is Mr. James T. Lynn, of Detroit, while Mr. Arthur Hewitt, of Toronto, is first Vice-President, and Mr. Oscar H. Fogg, of New York, Treasurer.

It seems amalgamation is in the air in the United States; for the statement comes across that one big Gas Association, embracing the engineering, commercial, and appliance manufacturing departments of the gas industry will be formed within the year, perhaps under the title of the American Gas Association. As a matter of fact, this news appears in the "Gas Record," who say that the formation of one Association to bring the several branches of the industry into closer co-operation was determined upon in order that the capital invested in the gas business might be more securely protected from losses that are now threatened through the activities of the competitors in the field against gas. The representatives of this capital, it is asserted, launched the movement at a meeting that was wholly unanimous in both spirit and expressions; and "there can be no doubt that the plan for one big Gas Association in the country is already under way."

The members then settled down to the reading and discussion of papers and reports. Of these, there were considerably over a dozen dealing with numerous matters connected more especially with the selling side of the business. Some notes will be given next week of the report of the Industrial Fuel Committee; but the contribution by Mr. W. T. Rasch, on the "Adequate Piping of Houses for Gas," will be found on p. 585 of to-day's number. Generally speaking, the subjects submitted were quite of a discussable nature; and advantage seems to have been taken very freely of the opportunities offered. It is not possible to notice the papers and reports in their strict sequence, owing to the irregular order in which they are reaching this side.

A start may therefore be made with the last one—on the "Correct Utilization of Heat," by Mr. L. J. Platt, of the Public Service Gas Company, Jersey City. In this the need for the services of high-grade industrial fuel specialists, to take in hand the development of the use of gas for big processes, and for the displacing of oil, coal, and producer gas installations, was emphasized; and it was added that there must be placed at the disposal of these men the means whereby they shall be enabled to apply gas fuel in the most economical and convenient manner. Touching upon the question of heat conservation, the author said that many gas-fuel appliances in use to-day suffer from over-ventilation, as the result of improperly proportioned flues or vents. In this connection, great aid to more efficient application of heat can be rendered by the occasional taking of flue-gas analyses and temperatures to indicate how much heat is being wasted, and what measures should be undertaken to prevent an excessive loss.

Given a furnace, said Mr. Platt, in which a maximum of radiant heat is produced, and a minimum of excess air, it is clear that this furnace must be highly efficient. Furnaces have been designed in which the mixing device creates homogeneous explosive mixtures of air and gas in their chemically correct proportions, and burns them with little or no flame, localizing the heat in an intensely radiant bed. In a comparative test of a usual-type oven furnace, and one designed to secure a large percentage of radiant heat, it was found that, to maintain 2000° Fahr., the radiant-bed type of furnace on two runs with the furnace not loaded took 26·6 and 25·5 per cent. less gas. To maintain 2200° Fahr., under the same conditions as before, 31·1 per cent. less gas was used; while to heat 1 lb. of iron through 1900° Fahr., it showed a gas saving of 28·4 per cent. The capacity of the radiant-bed type of furnace was considerably greater than that of the old-type furnace, because, burning 15 per cent. less gas per hour, it did the same work as the latter, in heating iron, in 18·8 per cent. less time. In one shop, using two soft-metal pots of the same capacity to melt a lead-antimony alloy, containing 12½ per cent. antimony, the daily average of the furnace using the radiant-bed method was 10·58 lbs. of metal melted per cubic foot of gas at exactly the same time and under the same conditions as the second furnace using the old method and melting 7·58 lbs. of metal per cubic foot of gas.

One of the most striking examples of the efficiency of the application of energy in the form of radiant heat to industrial work is shown by the utilization of radiant heat with the ordinary baker's dutch oven. The heating of tanks for melting semi-fluid products, formerly fired with coal or wood, is said to offer another striking example of the economy to be effected by the application of radiant, instead of convected, heat. In some operations, it is not feasible to use the radiant-bed principle of heat application; and it is necessary to bring into play a more scientific method of applying the principles involved in the present methods of combustion and heat utilization.

In the course of a paper on "Replacing Old Types with Modern Fixtures," Mr. Samuel Snyder, of Philadelphia suggested a number of new developments for gas lighting. He said that in the field of commercial lighting the demand for more powerful light sources is felt. The application of nitrogen lamps to semi-indirect fixtures in electric installations compels the use of larger sources in gas installations; and there is, therefore, a demand for eight-mantle horizontal burners. The demand for diffusion and the growing appreciation of semi-indirect lighting in churches and large auditoriums, has developed a field for large semi-indirect gas-fixtures using fifteen, twenty, and thirty mantles. The dark interior decoration of many churches, and the extreme heights of spaces to be lighted, require the development of a semi-indirect unit for gas equipped with a reflecting surface above the dish to return much of the light that would otherwise be lost against the non-reflecting surface of the ceiling. Semi-indirect lighting from vertical surfaces, such as walls, offers a solution to many problems wherein the extreme heights of ceilings render the overhead suspension of gas units impracticable.

Discussing the question of upright *versus* inverted fixtures, the author said the introduction of the "C.E.Z." burner during the past year, and the campaign of education incident to its introduction, have been responsible for a change from inverted to upright fixtures. Much ingenuity has been displayed in the design of the new upright fixture, which characterizes it as different from the former upright fixtures that did service for the open-flame gas-burner. The modern fixture is more logical, in that its structure is built-up in the body of the fixture itself, whereas formerly the fixtures were constructed with flimsy arms to support extremely large glass globes. The direct solicitation of the public by the gas company to improve lighting installations, and a personal interest shown in the selection of their fixtures, is a service that has much to recommend it.

(*To be continued.*)

ELECTRICITY SUPPLY MEMORANDA.

Some of the large electricity generating stations are, through the current combination of adverse circumstances, suffering from more than progressively heavier coal charges. These are the over-worked stations in industrial areas; and of them the Birmingham Corporation concern is an example—it having amply testified to its over-wrought condition by breaking-down on several and very inconvenient occasions. The Committee were the other day asking the Council to sanction an imperative increase in the charges to consumers; the Committee's ideas being represented by 15 per cent. advance to the lighting consumers, making it 30 per cent., and by 10 per cent. upon the 20 per cent. increase already made to the low-tension power, heating, and cooking consumers. The Council agreed as to the lighting consumers, but considered that the advance to the power, heating, and cooking consumers should be from 20 to 40 per cent. Under the coal clause in their contracts, the high-tension power users automatically pay an increase. So much for this aspect of the matter. Interest attaches to the causes for the increase. There is the question of the cost of coal. Birmingham and other electricity stations are not only paying much higher prices per ton, but they are paying the higher prices for coal of diminished quality, which, of course, means that more has to be used per unit of output, and more ash has to be handled. There are many gas engineers who can sympathize with their electrical compeers over this matter; for they, too, are paying heavy prices for qualities of coal which they dare not reject on the principle that a ton of coal delivered is worth to them more than two and more tons at the colliery. But what is the result? The inferior quality of coal not only means reduced make of gas, but the lower volatile matter and the higher ash content mean a difference to the value of the liquid bye-products and to the ash content of the coke, which are commercial disadvantages. Another point illustrated by Birmingham is that the heavy demands on the department have involved much strain upon the machinery and plant; and this is a condition that is likely to continue during the remainder of the year, inasmuch as new plant which should have been ready betimes for this winter is only now approaching completion. Naturally, with such strain repairs are unduly heavy, and considerable sums will be required to meet the accelerated rate of depreciation. That is another added expense. Upon all this are the enhanced costs of labour, rates and taxes, and general expenses. People are now accustomed to the hackneyed phrase "abnormal times." The Birmingham Corporation Electricity Department, however, can feelingly agree that they are so.

Over-Wrought Stations.

When the preliminaries to the collapse of the Ilford preferential charges case were under way, and it was thought that an actual fight, and not the prompt knuckling-under of the District Council, was to be witnessed, there were certain meddlesome persons who sent round begging of local authorities to subscribe something towards the costs of the action. The same thing appears to be going on at the present time in connection with the writ issued by the Gas Light and Coke Company against the Hackney Borough Council for alleged preferential charging. The "Electrician" has told its readers that the Hornsey Council have received a communication from the Hackney Council asking for a contribution of £100 towards the costs of defending the action brought by the Gas Light and Coke Company in respect of a lower charge made for electric energy supplied for lighting to customers who are also power consumers; "it being alleged that the charge constitutes an undue preference." The statement as it stands looks as though the Hackney Borough Council are "sending round the cap" on their own account, and that the Incorporated Municipal Electrical Association, who burnt their fingers over the Ilford business, are not having anything to do with the matter. It is not a very dignified thing for a Metropolitan Borough Council to be begging for the maintenance of litigation arising out of their own administrative policy; and to fix a definite sum as the contribution is a piece of presumption. Some people would use a more forcible expression.

Sending Round the Cap.

Under this heading, there is reproduced in the "Correspondence" columns a letter from Mr. C. G. Nobbs in reference to some inquiries that were put to him, in our issue for Dec. 5, regarding certain statements for which he made himself responsible regarding that hoary allegation of electricians as to the loss of "meat" in gas-heated ovens. The statement is—whether right or wrong—an item of such extreme commercial value that the electricians, suffering from so many drawbacks in connection with electric cooking, dare not abandon it, though their consciences must feel uncomfortable when they remember that loss of "meat" has relation to temperature, and temperature to the quantity of gas consumed, and that there are many other "losses" in culinary operations that are conducted electrically besides those pounds of "meat" that are supposed to go floating away from millions of homes every day. The atmosphere ought by this time to be heavy with the "meat" that has escaped in this way; but we find no difference. However, the Editor has put at the top of Mr. Nobbs's letter: "Mr. Nobbs Replies." Now that worthy has done nothing of the kind. We asked him to kindly tell us the name of the gas-range that he personally used in ascertaining the loss of meat. He does not do so. We asked him, too, the temperature employed in the gas-range that he personally used. He does not tell us. We put it to him: If the temperature was higher than that employed in the electric-cooker, why was it so, if the temperature of the latter sufficed to cook the meat to the extent required by the owner? Again, Mr. Nobbs does not reply. But the truth is out. He is like certain other electricians. He has not personally tried cooking two identical joints in the two different forms of oven at equal temperatures; but he takes refuge—in this matter, so truly electrical—behind others. "We are taught," he says, "in cookery schools, and told in reference books, that the loss varies from 20 to 33⅓ per cent., or even more, and which is demonstrated in ordinary everyday practice." In cookery schools or reference books! If Mr. Nobbs was told by some dear soul at a cookery school or in a reference book that 2 and 2 make 5, he would therefore probably quote it against the man who said the figures made 4. Mr. Nobbs ought to have known that the formulæ of schools and reference books in matters of practical and experimental data frequently have had existence for generations, and badly want real overhauling, and that it does not do to confidently rely on them without absolute proof that qualification is not needed. Mr. Nobbs has a lot to say in the way of panegyric on the electric-cooker; he omits to eulogize its weaknesses, which represent so much in kitchen operations. But he further misleads his readers by suggesting that our reference to a "singularly amusing piece of bluff" refers to the small loss of meat in electric cooking. It was nothing of the kind; the "amusing piece of bluff" is that which he himself supplied by quoting losses of good solid "meat" widely varying between gas and electric cooking without mentioning the differences of temperature employed in the two ovens. It was not a "platitude born of weary hours spent over the gas-oven," nor was it derived from a cookery school or reference book. As to those "weary hours," it happens that, if desired, cooking operations, including boiling, can be done, with greater speed with the gas-oven and hot plate than with the electric-cooker. But come, Mr. Nobbs, would you mind taking part in a public demonstration to prove that the assertions for which you originally took responsibility as to "meat" losses in gas-ovens are not capable of disproof, and then allow your name to be used in connection with the results?

Mr. Nobbs Replies.

Mr. A. T. Bullen is a philosopher. He has been writing in the "Electrical Review" regarding "Consumers' Complaints." With the proclaimed virtues of electricity, there ought to be no room for complaints. But there are, and they are many. He bases his article on the complaint a lady addressed to a morning newspaper noted for its unauthentic intelligence regarding scientific matters, that despite daylight saving her electricity account has gone up. It is not an uncommon complaint; and Mr. Bullen shows there are a hundred reasons any one of which might account for the increase in amount. But our friend is concerned to find why consumers as a whole do not appear to have such faith in the officials of the supply corporation or company as seems desirable. On the whole, the electrical people appear to have had a bad upbringing in connection with their business. Mr. Bullen says that one of the first principles of business seems to be to cultivate distrust of everyone with whom you have dealings, and that is why a dissatisfied consumer will complain to anyone and everyone except only those persons appointed specifically for the purpose of giving him the satisfaction he seeks. Naturally one searches for an explanation for so curious a condition, and wonders if the real reason is that those having the settling of complaints do not, by their mode of action, ability, and manner of address, inspire confidence. Certain it is that it is quite impossible to deal satisfactorily with any consumer unless he or she is confident that the advice you are giving is sound, and that your knowledge of the subject is complete. Perhaps, he says, more dissatisfaction and distrust are created by advice given by incompetent persons, the results of which have afterwards to be rectified, than by any other cause. He advises supervising officials to leave their test-rooms, and move among the consumers, and learn the conditions under which each is using electricity. We are pleased to see that Mr. Bullen considers that sympathy and common sense should also be attributes, because both are sometimes wanting. The same supervising official, he submits, should have a sound technical knowledge; but he should not air it to the consumer, save in such manner as is likely to inspire confidence. He is also asked to remember that it is easy to presume upon the electrical ignorance of the consumer, but that it does not pay in the end. Above all, it is necessary to be fair. Mr. Bullen is admirable; let us hope those concerned who read his article will prove themselves worthy of such a generous amount of thought and advice.

Consumers' Complaints.

A good story is told in the "Electrical Review" by Mr. T. H. U. Aldridge, the Engineer-in-Chief of the Shanghai Electricity Department. The gas industry is not troubled so much as it used to be by people who purloin gas. Some of these undesirables have doubtless transferred their attentions to electricity, and still practise their meter bye-passing, as cases occasionally prove. The electricity industry is welcome to

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these "customers." But though the British stealers of gas and electricity are a pretty bad lot, they cannot rival for cunning the Chinaman who was "split upon" by some unfriendly party, and was found to have been stealing electricity for a number of years. Investigations proved that the consumer had, by an ingenious contrivance fixed on the door of his house, so connected the shunt-wire leading to the meter that, when the door was open the shunt would be in circuit and the meter registering; so that whenever the meter inspector called to examine the meter it would appear to be working in order. When, however, the door was shut, the shunt circuit was broken, and so the meter would cease to register. The man had carefully concealed the connection where he had broken the shunt-wire behind a partition, and the two ends of the wire were connected on to a spring contact fixed behind the door. In the past Mr. Aldridge says that he has had considerably difficulty and trouble with the older type of meters with the separate shunt connection, as the Chinese soon learnt that, by cutting the shunt wire, the meter would cease to register. But for several years now all the meters have had both main leads taken in and out of the meter with the shunt connection made inside the meter, which is sealed. Consequently the opportunities for interfering with the registration of the meter have been reduced to a minimum. The case in point was one in which the old type of meter, having an external shunt wire, was installed.

The Hard Case of the Diesel.

The Diesel engine is suffering tremendously. Heavy charges for oil are against it making as good showing in fuel costs for electricity generation to-day; and so the users are falling back on tar oils. People who do not use Diesels are inclined to "chip" those who do on their propensity for giving (as proving their economy) only fuel costs and not over-all costs, seeing that it has become well known that capital, maintenance, and running charges other than fuel are not exactly on equivalent lines with other forms of prime mover, and the higher costs in these directions rather take the gilt off the claims for the Diesel. It is, also, now well appreciated that, if a Diesel breaks down, it prefers doing it on the grand scale. Now we learn that talented men are required to look after the fastidious Diesel—men who understand the "niceties" of its working. Such men, we learn from the "Electrical Review," are in number extremely limited; and the combing-out process without compunction for war purposes threatens to include some of the Diesel engine men. Already, our contemporary says, "we have heard of one Diesel station losing its chief engineer; and we know another which is faced with the prospect of an inevitable shut-down if one more of its staff is taken." Our contemporary considerately and modestly observes: "It is not for us to direct the policy of the Government." All it wishes to do is to emphasize this simple, incontrovertible fact—that if the Diesel experts are removed from Diesel engine-driven stations, these stations must inevitably shut-down. The gas industry is a highly technical one. It is in the same boat. It is always being harassed for more men; and yet it is urged to do more in getting larger quantities of benzol and toluol. But our contemporary need not despair. If all the Diesel engine stations have to close-down, the gas industry will comfort and look after the electricity consumers, and give them the convenience of a reasonably low intrinsic brilliancy light at a moderate cost, and an abundance of B.Th.U., at a much less charge than is possible with electricity.

Coke-Oven Gas for Boston (Mass.).

A contract between the Boston Consolidated Gas Company and the New England Gas and Coke Company that has been submitted to the Massachusetts Gas and Electric Commissioners for approval, relates to the purchase of coke-oven gas in bulk, and stipulates for the supply of the whole of the surplus gas of not less than 18-candle power (burner not stated) as produced at the coke-ovens at Everett, in excess of that actually required for the operation of the manufacturing plant. The gas is to be supplied unpurified from carbon dioxide and sulphur compounds, but will be purified by the Gas Company, and is to be paid for at the rate of 34½ c. per 1000 cubic feet as measured after purification. If the cost of purification—which is taken as including material, labour, repairs and maintenance of purifying apparatus, tools, water, steam, and all other incidental expenses—shall at any time exceed ½ c. per 1000 cubic feet, the Coke Company shall allow a rebate equivalent to the increased cost, as ascertained by multiplying the number of 1000 cubic feet by the average excessive cost, If in any single period of twenty-four hours the average candle power of the gas supplied shall fall below 18, the price shall be reduced 2 c. per 1000 cubic feet for each candle below this figure. The Coke Company agree to deliver at the Everett works not less than 2½ million cubic feet of gas per day; and if the supply falls short of this quantity, they are to pay the Gas Company 15 c. per 1000 cubic feet on the deficiency as damages. Unavoidable causes are excepted. Both the Commissioners and the Coke Company have the right to inspect and test the photometer and meter used, and a record of daily tests shall at all times be open to inspection by the Commissioners. The contract is to run for three years as from Dec. 1 next. If at the conclusion of this period, however, the Gas Company find that their existing generating plant is insufficient for economical production, and desire to continue the contract pending the construction of extensions, it may be extended for a further period of two years.

LOCAL ADMINISTRATION.

Public health, local administration, local taxation, and valuation are dealt with in Part III. of the forty-fifth annual report [for the year 1915-16] of the Local Government Board, which, much abridged, in due course made its appearance.

With public health, which takes up one-half of the reduced report, there is no need to concern ourselves here; but under local administration reference is first made to loans sanctioned to local authorities. It is pointed out that, in pursuance of the policy indicated in circulars issued early last year—namely, to avoid the inception of all new works except such as were of pressing necessity either for reasons of public health or else on account of war requirements, and to restrict the borrowing of money by local authorities within the narrowest possible limits—the practice has been to sanction loans to local authorities for new expenditure only where it was clearly shown that the outlay could not possibly be avoided, postponed, or reduced. In cases where local authorities had already obtained power to borrow, but had not at the time exercised the power, they were required to obtain further sanction from the Board or the Treasury before doing so. In regard to works actually in progress when the restriction on borrowing was imposed, authorities were urged to have recourse to postponement, or where possible to extend the period allowed under contract for their completion. Generally speaking, the report says, there has been little difficulty in stopping works at a stage where any deterioration or injury to the work already done would be avoided; and such suspension of the work has not, it is thought, usually resulted in any material hardship or loss to either the local authority or the contractor. It was found practicable, in one or two instances where pipes and fittings had been manufactured under contracts in connection with schemes of water supply, to arrange for their disposal through the Government, so as to enable work to be stopped without loss. There were cases in which the work was so near completion, or was of such pressing necessity on account of war requirements, that it would not have been in the public interest to stop it; and in a few other instances health considerations made it desirable to grant permission to proceed.

It is admitted in the report that it is not possible to state in figures what savings have been effected by the stoppage and postponement of works, inasmuch as many authorities suspended or deferred works in hand or in prospect without action on the part of the Board. It is, however, mentioned that, of the total loans, amounting to £13,601,695, that were sanctioned during the year ended March 31, 1915, it has only been found necessary to re-sanction the raising of loans amounting to less than £1,500,000. Of applications made during the twelve months ended March last, sanction has been refused to loans either wholly or in part in more than 700 cases, involving in the aggregate a sum of approximately £3,000,000. In cases of expenditure on work which had not been commenced, the general policy has been only to sanction loans where the expenditure was urgently needed for the furtherance of the war. The bulk of this expenditure has been for extensions of plant and cables for supplying electrical power to those engaged on war work. Several loans have also been sanctioned, after consultation with the Ministry of Munitions, for extensions of gas-works and plant required to meet increased demands for gas. These loans were sanctioned, it is pointed out, as the works proposed involved a considerable increase in the production of materials used for the manufacture of high explosives. As a matter of fact, the total amount of loans sanctioned in the year ended March last was £4,257,973; figures which compare with £13,601,695 in 1915, and £14,683,131 in 1914.

Acting on the view that the present time is inopportune for the putting forward of contentious proposals, involving in many cases considerable expenditure on legal and parliamentary costs, the Board state that they have decided not to facilitate applications for the alteration of administrative areas unless all parties are in substantial agreement. They have also endeavoured to confine to essentially urgent cases applications for the issue of Provisional Orders putting in force the powers of the Lands Clauses Acts for the purchase of land otherwise than by agreement. And to this end, it was decided this year not to issue any instructions as to applications for Provisional Orders, and to try to secure that only such Orders should be issued as were not likely to be seriously opposed.

Space has been found within the narrow proportions into which the report has been compressed, for some reference to legislation in 1915-16; and one of the measures which are shortly explained is the Special Acts (Extension of Time) Act, 1915. This is an Emergency Act having effect only where applications under it are made during the continuance of the war or a period of six months thereafter. It enables the appropriate Government Department to extend by Order the time-limit for the performance of a duty or the exercise of a power under Local Acts, &c. Orders under the Act have been issued on the application of various authorities. In six cases the Orders extended the time for the compulsory purchase of lands under powers conferred by Local Acts or Provisional Orders; and in two, the time for the completion of works authorized by Local Acts. In the other instances, they extended the time for the operation of certain provisions in Local Acts.

Among the associate members elected at the last ballot of the Institution of Civil Engineers was Mr. Randolph E. Docwra.

NEW SOUTH WALES AND QUEENSLAND GAS INSTITUTE.

Second Annual Meeting in Sydney.

WELL attended and successful in every way was the second annual meeting of the Institute, which was held in the Royal Society's rooms, Sydney, on Oct. 24, under the presidency of Mr. R. J. Lukey, the Secretary of the Australian Gaslight Company. Three papers were read; and these led to profitable discussions. The report submitted showed that the Council had been hard at work during the past twelve months; and these labours will undoubtedly prove profitable to the industry. On the day following the meeting, the members, as the guests of the Directors of the Australian Gaslight Company, visited the Mortlake works; and on the way there by steamer they were enabled, by permission of the North Shore Gas Company, to inspect the Oyster Cove Gas-Works. We are able to-day to give an abstract account of the business proceedings.

In their report covering the twelve months ended Sept. 30, the Council stated that they had held many meetings, chiefly for the purpose of considering the proposed amendments to the regulations of the Gas Act, 1912. Conferences took place with the Chief Gas Examiner; and the Council felt that their efforts had met with a certain amount of success. They had also considered a set of rules governing the examination and licensing of gas-fitters. The Council deemed it desirable that the rules should be so amended as to permit members of the coke and other coal products industries to become members of the Institute. As no nominations had been received for office-bearers and members of Council for the ensuing year, the Council themselves nominated the following:

President.—Mr. A. Wilson.
Vice-President.—Mr. J. C. Alexander.
Hon. Treasurer.—Mr. S. J. Janes.
Hon. Secretary.—Mr. H. Tindale.
Members of Council.—Messrs. J. M'Auliffe, J. Mackenzie, and A. G. Ambrose.
Auditors.—Messrs. T. F. Waugh and E. Foster.

PRESIDENTIAL ADDRESS.

Mr. LUKEY after remarking that, out of 2000 employees of the Australian Gaslight Company, over 300 have volunteered for active service, said the demand for gas in Australia is steadily on the increase; this being largely due to increased activity in industries engaged on the production of materials to take the place of those previously imported from other countries.

In consequence of the disruption of trade in the Old Country, due to so many firms being engaged on the manufacture of munitions and other war materials, it has been impossible to secure the manufacture and shipment of plant and materials necessary to cope with this increased demand. Extensions of works and mains have suffered thereby. This has been in one sense beneficial, as it has stimulated the powers of resource, and quickened the inventive faculties of those whose business it is to direct the operations of the gas and other large industries in this country. They have been forced to look around for other sources of supply, and in their patriotism naturally turned first of all to their own country, which, though young in years and experience, it was felt had that essential quality in its composition which warranted their confidence. The result has fully justified the placing of that confidence; and Australia to-day has taken one great step towards being a manufacturing nation. Plant of all description is now being produced here which formerly would have been considered impossible.

We cannot forget the part which the gas industry has played in the conduct of the war. Toluol and benzol for the manufacture of high explosives are now being extracted from every gallon of coal tar in the Old Country—not an ounce of it is allowed to escape. I know that the members of the gas industry in this country only require to be impressed with the seriousness of the position to at once follow the lead of their brethren in the Old Country. I am committing no breach of confidence when I tell you that the preliminary steps have already been taken, and the means by which you can best help in this struggle of the Empire will very shortly be communicated to you.

The rise of the gas industry in Australia is a subject worthy the attention not only of the members of this Institute, but of all to whom the history of the country appeals. As is well known, the inception of the industry in Australia took place in Sydney in the year 1837; and its growth since that date has been on a par with the growth of the country generally. Though it is impossible to give actual records of its progress, it will not be contradicted that it has surpassed in rapidity that of the industry in any other country. This rapid growth has been particularly favourable to the industry generally, as owing to the never-ending additions to, and extensions of, plant, it lent itself to advantage being taken of the most modern improvements in such plant. The gas industry in Australia to-day takes pride in the fact that, generally, the plant and methods in use here are, on the whole, more up-to-date than those in use in any other country. While a contributing factor to this condition has been the increasing demand for gas, necessitating constant additions to plant, yet every credit must be given to those responsible for the direction of the industry, who, with characteristic foresight and perception, at once seized on those improvements likely to be of service, and adapted them to suit their local conditions and requirements, or developed them along lines of their own, and placed the gas industry in the proud position it now occupies.

No consideration of the rise and progress of gas in Australia can be complete without some reference to the Australian Gaslight Company—the parent Gas Company in the Antipodes. The installation of gas for Sydney, as already stated, was definitely decided upon in the year 1837. The city up to then had to depend upon oil-lamps and candles for illumination. After the necessary authority from Parliament was obtained, the whole of the material had to be imported from England; and it was not until 1841 that the lighting of the city by gas was an accomplished fact, as in those days sea voyages were much more prolonged and risky than at present. A short time ago I met an elderly lady in Ashfield, who, in course of conversation, informed me that she well remembered, as a little girl then living at Miller's Point, being taken out by her father to see the streets of Sydney lit by gas for the first time; and the effect was vividly impressed upon her mind to that day. It must be remembered that Sydney was then in its infancy, and Ashfield a bush settlement.

The Company's prospectus, issued in 1836, appealed for capital to "enable the Company to accomplish the lighting of the large, increasing, and opulent metropolis with gas, and to enable its inhabitants to perambulate its streets when thus brilliantly illuminated." The response, however, would not in these days appear to be very encouraging; but the Directors evidently thought so then, as they tell us in their report that they were afforded much satisfaction in being able to report that the capital subscribed amounted to £8290—the original estimate for the first gas-works in Australia being £20,000. Nothing appears to have daunted the courage of the Directors; so that success ultimately crowned their efforts, and the Australian Gaslight Company is now one of the most flourishing institutions in the Commonwealth.

It may be of interest to you if I give you the following comparative statement regarding the progress of the Company:

Years 1843 (First Complete Year) and 1915 Compared.

1843.	1915.
Capital employed, £44,950	£3,054,250 (subscribed and loan)
Revenue, £12,125	£826,521
Coal used, tons, 1976	381,094 (coal and oil combined)
Gas made, cubic feet, 12,124,000	4,403,173,000
Number of consumers, 436	130,000
Price of gas when measured by meter, 25s.	3s. 10d.

By the courtesy of the Directors, the members of the Institute will be guests of the Australian Gaslight Company, and will thus have an opportunity of visiting the Mortlake works, where the whole of the Company's operations will, in a short time, be carried out; the head station at Kent Street, in the city, having been resumed by the Government. At this station, the most up-to-date plant and machinery have been installed, including vertical retorts, the telpher system of handling coal and coke, and the erection of one of the largest gasholders in the world, having a capacity of 12,000,000 cubic feet. The works cover an area of over 80 acres, and are now one of the largest and most modern installations in the British Empire.

It is most gratifying to note that what is termed the "day" consumption of gas—*i.e.*, between the hours of 6.0 a.m. and 6.0 p.m.—has much improved of late years; so much so, that some companies can report a uniform rate during the whole twenty-four hours. This satisfactory condition of affairs has been brought about chiefly through the more general use of gas-engines, gas-cookers, gas-fires, and other heating appliances. In the competition that awaits us in the future, all our energies will have to be directed to the extension of the use of these appliances. In a hot climate such as Australia, there should not be a house within reach of a gas-main without such conveniences. Up-to-date show-rooms should be accessible to the consumers, and lectures on gas cookery, and instruction classes, established in convenient centres of fully-qualified lecturers. The outlay might be heavy; but the return from the increased sales of gas would soon recoup such expenditure.

While the demand for gas in Australia has increased, and no difficulty has been found in inciting such a demand, the same cannot be said of residuals. Gas undertakings in this country have been faced with the difficulty of advantageously disposing

of their residuals. In this, they are differently placed from their brethren in the Old Country, which, being a manufacturing country, readily absorbs all such residuals. Indications are not wanting that this state of affairs is about to undergo a change; and it is hoped that soon a ready and profitable market will be created.

The introduction of "penny-in-the-slot" meters gave a great impetus to the consumption of gas by the working classes. The use of the gas-ring and small cookers played a great part in this direction, and should be encouraged wherever possible. As an illustration of this, I have only to quote the experience of my own Company, whose revenue from this class of consumer last year was no less than £89,683, which represents 21½ million pennies, or 200 tons weight of bronze metal.

The "Gas Act, 1912," has imposed upon gas companies many restrictions, which, in my opinion, are both unnecessary and uncalled-for. While not objecting to the sliding-scale regarding dividends and price of gas, so long as the rates are fair and reasonable, yet, in regulating the latter, more attention should have been paid to local conditions when fixing the standard rate of gas for instance. When it is considered that wages in Australia, under normal conditions, are 100 per cent. higher than in England, and the principal machinery and plant have to be obtained from abroad, it is not right to expect our companies to supply gas any way near the rates ruling in England. In saying this much, it must not be inferred that I am in favour of dear gas; on the contrary, I have always advocated that it should be supplied to the consumer as cheaply as possible.

A HOME-MADE WATER-GAS PLANT.

By A. G. Ambrose, of Bathurst.

This was a brief description of home-made apparatus erected at Bathurst during the great coal strike in 1909-10.

On the day the strike was declared there was barely three weeks' coal supply on hand. Fortunately, however, it being summer time, the demand for coke had fallen to practically *nil;* so a large quantity had accumulated in the yard. This it was decided to utilize by conversion into water gas. During the progress of assembling and erecting the water-gas plant, the rapidly diminishing coal supply was husbanded by manufacturing wood gas. This served the purpose very well for a few days, then trouble commenced, by the wood tar, coal tar, pyroligneous acid, and ammoniacal liquor forming an emulsion in the hydraulic main, so thick that the tar overflow blocked very often, and, of course, a heavy seal was thrown upon the dip-pipes. All these troubles ceased shortly after the water-gas plant was brought into commission; and very little trouble was experienced from stopped pipes during the remainder of that anxious period. It must be clearly understood that the plant described below was merely a makeshift one, and only intended to tide over a very trying and critical period. When the tension was released, and coal was once more to be had in abundance, there was no further need for the plant; so that it was dismantled, and the engine and pressure blower returned to their respective owners.

The generator consisted of an iron shell, of boiler plates 12 ft. by 6 ft. and 7 ft. high, with the usual clinkering door and fire-bars. The shell was lined with 9-inch fire-brick, having a backing of slag wool, 1½ inches thick, firmly packed between the bricks and the shed. A division wall, also of fire-brick, was built across the centre, thus dividing the shell into two separate chambers A and B. At the lower part of the dividing wall, and about a foot above the fire-bars, was an arched opening, 18 in. by 18 in.; thus internally connecting the two chambers with each other. Two self-sealing retort mouthpieces performed the dual duty of charging doors and an exit for waste gas while blowing-up. The blast-pipe leading into the generators were 6-inch dip-pipes, the flanges of which made a gas-tight joint between the blast-pipe and shell. The gas outlet pipes were each provided with a rack-and-pinion valve, and connected direct to the foul main on the top of the retort-bench, where the water-gas produced mixed with the hot gas as it came from the retorts. The air blast was maintained by a Sturtevant high-pressure blower, loaned for the occasion by a friend; and the power to drive the fan was supplied by a portable compound engine brought down from the Bathurst Municipal Council's stone quarry. So that the only thing that had to be purchased was the boiler shell plate. The steam was connected to the top and bottom of each chamber, and was superheated before reaching the generator by passing through pipes laid in the waste-heat flue of a regenerator retort-setting just adjoining the water-gas plant.

The operation of gas making was conducted as follows: A fire was kindled on the grates, fed with coke, and heated to incandescence by the air-blast. The blast was then shut off, the charging doors closed, and, after opening the gas-valve leading from compartment A, the superheated steam was injected, along with coal tar, into compartment B. It will be observed that the whole of the gas produced had to pass down through the mass of fuel in B, thence into the compartment A, and in so doing the tar was vaporized and the gases fixed; while the coke acted as a filter, retaining the carbon produced during the decomposition of the tar. The whole of the gas produced was at once passed into the foul-gas main, where the hot gases from the producers and retorts mixed.

After the gas-making run was completed, the two fires were blown-up in parallel for about two minutes; and the direction of gas making was reversed after each blow. It was found that the best results were obtained when the steam and tar were running about ten minutes and steam alone for another four minutes.

During the last six weeks of the strike not a pound of coal was available, yet a supply of between 150,000 and 160,000 cubic feet of 15-candle gas was produced per day. Although coal was unobtainable at any price, shale could be had in abundance. This made an ideal enricher, and as such was used right throughout.

EXPERIENCES IN QUEENSLAND.

By D. A. Campbell, of Lithgow.

In this paper, the author related his experiences in various country gas-works in Queensland, beginning with Rockhampton—where "the owners attempted to make the machinery themselves, but were not successful."

My next experience, said Mr. Campbell, was at Gympie. The works were rather crude. In the retort-house, the bench consisted of two beds, with five retorts in each. The hydraulic main was in one length for the two beds, and the foul main, instead of being carried round the retort-house for gradual condensation, went right through the wall from the hydraulic main into the open to a very large condenser. This was not protected in any way. Gympie in the winter is very cold at night. The consequence was the whole works became troubled with naphthalene. Men had to parade the main street at night with tins of kerosene and a funnel, and, when they saw lights in a shop go out, rush in, disconnect the inlet to the meter, and pour some kerosene down the service-pipe. This would dissolve the naphthalene. In the works we had to take the flanges off the inlet and outlet pipes, pour boiling water down, and use a plunger.

I took charge of the Maryborough Gas-Works in the middle of the Great Flood of 1893. The water was 4 feet high in the retort-house. The water had risen so rapidly that they neglected to shut the valves at the holders, and the mains became full of water; and as the town is very flat, we had considerable difficulty in getting rid of it. I found these works one of the most complete at that time in Australia—that is, of course, for a country gas-works. The population was about 10,000, and the output of the gas-works 12,000,000 cubic feet. The retort-house was 100 ft. by 70 ft., with a chimney in centre. All it contained when I took charge was a bench of four beds of six retorts each, 9 ft. 6 in. long, direct fired. The bench looked like an island in a great sea. The condensers were 4 feet diameter. There were four purifiers, 10 feet square, with first-class centre valve, a Livesey washer, duplicate exhausters and gas-engines; and all of them were fitted with four-way valves. The foul main and the leading main were 10-inch. The Directors thought that the town was going to progress; but for some years it had been going the other way. I found the consumption decreasing, and a universal complaint of bad gas-fitting.

I consider that the greatest enemy to a country gas-works is the local so-called gas-fitter. As a rule he is not a fitter at all. I got my Directors to allow me to start a gas-fitting shop, and to instal gas-cookers, &c. These cookers could be obtained for cash, time payment, or rental, at so much per month. I also undertook to keep in order, at a price per month, the public buildings, churches, railway station, and large shops. The idea succeeded. When I left, the Company employed five gas-fitters; and the day consumption was 47 per cent. of the output.

There are no Municipal gas-works in Queensland—there are only two works of under 10,000,000 cubic feet per year. Ipswich is, I believe, the only country gas-works in Australia to instal vertical retorts. The make is only 33,000,000 cubic feet. Brisbane proper still uses horizontal retorts. South Brisbane has introduced verticals.

A FEW QUERIES.

By C. E. Layh.

The object of Mr. Layh in writing his paper—to promote discussion—should have been well attained; for he asked some half-dozen or more questions on which he desired information, any one of which would provide material for a first-class debate. It would, however, be of little use to reproduce the questions here, without being able to supply the answers which were no doubt forthcoming at the meeting.

Gas-Works Coke for Boilers.—At the regular monthly meeting of the Association of Engineers-in-Charge last Wednesday, Mr. S. G. Martlew, the Chief Engineer at the St. Marylebone Workhouse, read a paper in which he related his experience with gas-works coke as a boiler fuel. This year he reduced his consumption of Welsh coal by the use of gas-works coke; and by so doing he has so far effected a saving of £750. Careful management of the coke fuel has been responsible for much of this saving. On the introduction of the coke fuel, one of the instructions given to the stokers was, "When using coke, never entirely shut the dampers." This was to guard against possible collections of gas in the flues at standing times, which might lead to an explosion when the fires were stirred-up for a resumption of load. The coke was burned in the Lancashire boilers in use by means of the impelled draught apparatus supplied by the London Coke Committee.

WAR-TIME LIGHTING ECONOMY AND RESTRICTIONS.

The members of the Illuminating Engineering Society last Friday evening had a paper from their Hon. Secretary, Mr. LEON GASTER, entitled "Some Events during the Vacation, with Special Reference to War Economies in Lighting." We will confine our notice of the paper to the portions relating to lighting economies and restrictions.

ECONOMY IN ARTIFICIAL LIGHTING.

In dealing with the question of economy in artificial light, the author said: The national importance of economizing in fuel supplies has led the Board of Trade to issue circulars requesting consumers to diminish their consumption of gas and electricity for lighting, and inviting gas and electrical supply undertakings to co-operate in bringing about a 10 per cent. reduction. Judicious economy in lighting, by which is meant prevention of the waste of light, and its application in practice in the most efficient manner, is one of the main objects of our Society. The advice widely placarded on the official notices throughout London: "Don't Waste Coal, Gas, or Electric Light"—meets with our full approval. It is, however, necessary to supplement this advice by more detailed instructions as to how this waste can be avoided; and here our Society, which is constantly engaged in studying the proper methods of using light, is already doing national service. If the advice contained in the little pamphlet issued in 1913, entitled "Light and Illumination: Their Use and Misuse," were generally followed, a very large saving, accompanied by an improvement in the conditions of illumination, would be at once secured.

On the other hand, we have abundant evidence that the mere diminution of illumination, in cases where it is even at present insufficient for the purpose in view, is false economy. I have so frequently referred to the conclusions of the Home Office Report on Factory Lighting—that good illumination is essential in factories and workshops, and that defective illumination leads to diminished output, spoiled work, and an increased number of accidents—that it seems hardly necessary to go over this ground again. I should like to mention, however, that these conclusions are strongly endorsed in the series of bulletins issued by the Committee on the Health of Munition Workers during the present year—particularly in No. 9 relating to "Ventilation and Lighting of Munition Factories," and No. 15 (just issued) on the "Effect of Industrial Conditions on Eyesight." No one, at the present moment, would think of handicapping our munition factories by restricting the supply of gas or electricity, either for power or for lighting; and the same applies to all productive work, both from the economic and hygienic standpoints.

A well-considered scheme of economy, therefore, can be made effective only through the systematic education of people to appreciate the proper use of light; and the authorities would greatly assist the objects they have in view if they were to make use of this Society to prepare definite instructions on the subject to various classes of the community. I may say that I have reason to believe that suggestions from us in the proper quarter would receive sympathetic consideration.

Meantime, we have before us every day many examples of wasted light. We see lamps in shop-windows shrouded with coloured paper or obscuring lacquer so that a mere fraction of the light produced is allowed to penetrate through the screen, and carry out any useful purpose. In interiors we see old and wasteful types of lamps still employed, or lamps used without any adequate form of shade or reflector, throwing a large part of the light where it is not required. One difficulty which one meets in making economies is that of obtaining a proper supply of the best types of reflectors. The shortage is presumably due largely to the exceptional demands of munition factories, and to limitations in manufacturing facilities or material.

Assuming the need for economy, we are still in want of more definite information about the intensities of illumination actually required for various manufacturing processes. So far, however, there has not been an exhaustive scientific investigation, based on actual results achieved with varying amounts of illumination. From the standpoint of economy, it is very important to determine the approximate upper limits, beyond which no gain in output or quality of work is to be obtained.

LIGHTING CONDITIONS IN THE STREETS.

I come now to another aspect of economy in lighting—viz., the diminished illumination in the streets. I wish to make it clear that we are all willing to abide loyally by any conditions demanded in the interests of the safety of the country; and I do not mean to discuss this matter in relation to precautions which the authorities consider necessary with a view to minimizing the danger from hostile aircraft. At the same time, we cannot help being conscious that, if the assistance of those who have made a study of illumination for years were more effectively utilized, it might be possible to improve on the present arrangements in many respects—to make economies that would be very desirable at the present moment, and to provide conditions of illumination which, while meeting the views of the authorities, would make the streets more tolerable for traffic and pedestrians.

When the diminution in illumination was first undertaken, we offered our services to the authorities. Subsequently, early in 1915, a Joint Committee was formed with a view to aiding them in this matter; and we are still anxious to be of assistance. Two years have elapsed; and there is now opportunity to judge the effect of these lighting conditions. One fact that has been strikingly brought out is the increase in the number of accidents due to motor vehicles in the Metropolitan Police District:

Year.	Fatal Accidents.	Non-Fatal Accidents.
1913	424	13,153
1914	493	14,638
1915	666	16,366
1916 to Oct. 31	509	11,627

This increase has taken place in spite of a number of factors which should tend to diminish accidents, such as the diminution in the number of people and vehicles in the streets, the slower speed of traffic, the greater care exercised by drivers and pedestrians, and the tendency to greater sobriety since the outbreak of war.

The relation between diminished illumination and accidents, therefore, deserves careful study; and the following additional information would furnish useful data for drawing conclusions on this matter:

(1) The returns of the accidents during each month of the period referred to above.
(2) The respective numbers of accidents in each month during the day, and between sunset and sunrise.
(3) The dates at which further restrictions in lighting have been introduced.
(4) The approximate figures for the number of licensed motor vehicles, tramcars, &c., plying in London each month.
(5) The dates at which restrictions, if any, in the speed of such vehicles have been introduced.

The importance of the matter was emphasized at the conference called by the London General Omnibus Company on Friday, Dec. 1, with a view to forming a "Safety First" Campaign Council for the Metropolitan area. Mr. Blain, the Operating Manager of the Company, and the originator of the conference, explained that the movement had its origin in a general desire to promote safety in the streets even before the present darkening took place. The present conditions, however, make the movement especially welcome; and it is not surprising that at the meeting most of the speakers referred to the anomalies in the treatment of lighting in different districts.

There are many aspects of the subject to be considered. In addition to the question of accidents, there is the choice of methods of dimming the lights which will waste as little gas and electricity as possible. There is also the question of accidents, referred to above. And there is further the very important consideration that the mere slowing-down of traffic (in some streets to a walking pace) is, especially at busy times of the day, a great economic loss.

It is evident that the greatest measure for the safety of the streets would be the more scientific darkening of the lights. One undesirable feature of the present arrangements is the extreme "patchiness" and uneven distribution of light, giving rise to severe contrasts of light and darkness. There seems reason to believe that this inconvenient effect has not been deliberately sought for any purpose, and that it is merely the accidental result of the crude methods of shielding the lights now being employed. One of the first points to receive attention in a scientific inquiry would doubtless be the elimination of these severe contrasts in light and shade, which are distracting alike to drivers and pedestrians, and are probably not desirable, as forming distinct marks on the roads when viewed from above. The great variety in method prevailing in different districts apparently arises from the fact that a number of different authorities are concerned with the matter, whose directions are often more or less conflicting. In addition, it would appear from the results that the actual measures taken are often decided by people having little experience of lighting problems, and who do not appreciate the great difference in convenience occasioned by apparently small variations in procedure in dealing with public lamps. Now that the darkening of London has been experienced for over two years, is it not time for a comprehensive inquiry to be made, and for the establishment of a central authority to deal with the matter—taking into account all the various aspects of the question, and bringing about greater uniformity in the measures taken throughout London and possibly throughout the entire country? I believe that in this way it would be possible, not only to get better results from the standpoint of the public safety, but to make a very considerable saving in gas and electric consumption. Many of the present methods, which involve darkening almost the entire surface of the globe of a powerful lamp, are most unscientific and uneconomical; and at present there is apparently no body whose duty it is to see that better methods are adopted.

Gas and electric supply companies are, to a great extent, tied by their existing contracts; and neither they nor the borough councils are inclined to embark on rearrangements of lighting systems which may afterwards be vetoed. They are also perplexed by their efforts to meet the wishes of various authorities, some of whom consider the interests of traffic, others economy in lighting, others only precautions against hostile aircraft, but

none supplying a definite specification stating how all these requirements can be most economically and efficiently met.

Our Society—which numbers among its members engineers concerned with both gas and electric supply, makers of lighting appliances, and experts in touch with various Government Departments, and which has made a special study of lighting problems and the compromise between different aspects of lighting which they involve—should be in a particularly favourable position to give assistance in this matter.

DISCUSSION.

Mr. H. E. Blain (L.G.O.C.) remarked that, at the "Safety First" Conference referred to by Mr. Gaster, most of the speakers alluded to the lighting problem of London. It seemed to him it might be called the gloomy problem of London. There was an impression at that meeting that there was no necessity for the present conditions at night time; and he thought that the Society, consisting as it did of gas and electric lighting experts, should be able to bring forward some scientific suggestions for consideration in connection with this phase of the campaign. Travelling through the Metropolitan area at night time, one saw a great many lighting anomalies. One district was well lighted; another badly lighted. As a motorist, he considered this was very dangerous to the public. From observations that had been made, he thought there was very little chance for aerial intruders at night time to ascertain any particular locality unless the lighting was of great intensity indeed. He knew of some interesting experiments that had been made with a balloon in connection with the working of different street-lighting schemes.

Mr. F. W. Willcox considered that a method of controlling light should be developed so that there would be no occasion to dim it save when necessary through the approach of enemy aircraft. In this way the public would have the advantage of full lighting during the dark hours, and only dimming during the period of danger. If, however, restricted lighting was continuously necessary, he thought it would have been better to have placed temporary wooden posts, about the height of a man, along the edges of the pavements, with small lamps on them; and these would have served as definite guides for the traffic. It was purely a question of engineering, arrangement, and adaptation. The problem had not been approached from this standpoint at all; but an extinguisher had been simply applied, with the result that the light was really no light at all, but practically gloom.

Mr. A. Cunnington (L. & S.W. Ry.) said that something of the kind suggested by Mr. Willcox might be done. Another plan would be to have alternate lamps on alternate circuits—the lamps being alternately full light and dimmed-down. The full light lamps could be used at ordinary times; and the dimmed lamps in times of emergency. A method of the kind had been successfully adopted at Waterloo Station, with the concurrence of the authorities. It was entirely a matter of control; and it would not be very costly in most cases. Regarding the obscuring by colouring-over of skylights or the use of blinds, in one case of which he knew, the skylight had been obscured, and three burners had had to be kept going through the hours of daylight. Blinds were then adopted; and the daylight use of the gas-lights dispensed with. The cost of the blinds was saved in ten weeks by saving the daylight consumption of gas.

Mr. S. R. Mullard thought the members of the Society should direct their energies in the direction of making it quite impossible to have improperly lighted workshops. Whatever means could be adopted to impress this point on the authorities should be put forward.

Mr. W. Wyld (Electrical Engineer of Hampstead) remarked that, when the new regulations came out, the diminution of the lighting had to be done in a hurry; and the Borough Councils had to do it with as little expense as possible. This no doubt accounted to a great extent for the poor way in which the work was done. He, however, quite agreed with what had been said. The present lighting arrangements in London were shameful; and his own borough was by no means a shining example. If they could have their own way, they could carry out such a suggestion as that made by Mr. Willcox with advantage. Regarding the economy in artificial lighting during the operation of the Summer Time Act, he took out about a hundred examples from private accounts; and they varied from a 15 per cent. to a 33 per cent. reduction. But the output of his station only diminished by about 11 per cent., and he attributed the difference to the development of the cooking and heating load.

Mr. J. S. Dow said that one of the things the Society had been trying to do was to bring about more concerted action between people who supplied and used light. This was why the mere appeal to diminish the lighting seemed to many of them to be such a singular step, when they knew perfectly well that the great majority of people used, as a rule, very much less light than was wanted; and the trouble was to get them to bring up their illumination to a respectable figure, though at the same time it was true that other people used more light than was desirable. About the lighting of the streets, there was an utter lack of any kind of standard. This was the more surprising in view of the fact that there was quite a large amount of information now available regarding the intensity of illumination of different classes of streets. At the time the general specification for street lighting was introduced, showing the minimum illumination for different classes of streets, the figures went down to something like 0·05 foot-candle. He did not think any instrument had been developed which would read low enough to measure the present street illumination. It was inconceivable to him that if one had an illumination of (say) 0·01 foot-candle that it would be a source of danger; but it would make all the difference in the world between comfort and discomfort. He thought that it would be possible to make a little rough device which would indicate a low illumination, if there was some reasonable expectation that, when made, the results obtained by its aid would be utilized, so as to overcome the differences in practice, and make the streets more tolerable. With regard to normal public lighting, co-ordination was a thing they had to try to bring about; and he agreed that a central body should be formed for survey research into the lighting industry as a whole, though he admitted that the problem was not an easy one to solve.

Mr. Gaster, in replying to the discussion, gave hope that co-ordination in the existing lighting arrangements of the streets of the Metropolis might be effected. He thought that safety might be achieved by securing better street lighting conditions, and yet the lights not be visible to "the man above." At the present time, they were suffering from unscientific darkening.

ADEQUATE PIPING OF BUILDINGS.

A paper on this subject was presented by Mr. W. T. Rasch at the annual meeting of the National Commercial Gas Association, held at Atlantic City in November; and by way of preface to an abstract of the paper, the "American Gas Light Journal" remarks that, although the adequate piping of buildings is obviously the first and most important feature in connection with the utilization and extended consumption of gas, the value of which can scarcely be over-estimated, it has received but little attention from the gas industry. Much time and thought have been devoted to manufacturing problems, to perfecting appliances, and to devising new uses for gas. This may go on to any extent; but the time, energy, and capital so bestowed will be largely discounted unless attention is at the same time directed to the complete and adequate piping of all buildings for gas at the time of their erection.

The necessity for activity in this direction is only now being understood, perhaps because before other methods of artificial illumination came into existence all new buildings were piped for gas as a general rule. Confident that this state of things would continue, the gas industry has been led to overlook the possibility of gas being considered of but secondary importance, and that the omission of gas piping in new buildings is a natural consequence. Supreme confidence in the superiority of gas was not shared by the general run of architects and builders—not that gas had been superseded by a more efficient or more economical medium, but simply because the newer industry had been more actively exploited, and had realized the natural reward. The gas industry must set aside this confidence by demonstrating, actively and conclusively, that gas for light, heat, and power possesses such pre-eminent characteristics, that the omission of gas-pipes from a building means a curtailment of its productive or letting value; and a combined effort should be made throughout the country to bring the matter before the attention of all who either design or erect buildings.

Mr. Rasch stated in his paper that some three years ago the Consolidated Gas Company of New York, recognizing the need for systematic attention to the piping of new buildings for gas, established an "Architectural Service Bureau" as a branch of the commercial department, for the purpose of interviewing architects and others interested in new buildings, and urging the necessity for adequate gas piping. When a new building was under consideration, the architect was over-run with salesmen and representatives, to say nothing of all kinds of advertising matter, and gave little attention to such activities. The Gas Company therefore took up an independent line—that they were out to give service and render assistance in planning all details from the service supply to the various points of combustion—such as the several sizes and location of pipes and outlets, and suggesting the various uses of gas for which provision should be made. The result had been the establishment of satisfactory relations with architects and builders, and the gas officials were regarded as different from the ordinary run of trade salesmen.

All new buildings were taken in hand before the commencement of actual construction—daily information as to all new projects having been arranged for; but the inspectors also followed the construction, and saw that there was no deviation from the original plan. It was not sufficient to leave the matter, after getting the architect to include an ample gas-piping scheme in his estimates, because the scheme might be curtailed, or even cut out entirely, by the owner and builder. If anything of this sort was observed, the question was immediately taken up with the architect before the completion of the building. A report on each case was kept in view until the finish, when they were all stamped "final," and filed. The Company thus not only secured an accurate record of all that was done during the progress of the work, but also a useful record of the actual installation. If any commercial prospect was disclosed in the course of

consultation or inspection, a suitable slip was immediately forwarded to the appropriate department. Special forms were used for street connections, service locations, meter installations, &c., because close co-operation between the several departments, securing prompt attention to orders, was an essential feature. While slackness or negligence was resented and had a bad effect as regards any future business, prompt co-operation was greatly appreciated.

Numerous arguments in favour of piping buildings for gas during construction were available; but those actually addressed to the architect were selected to suit the particular case. Usually the suggested lay-out was adopted; and the architect was grateful for the voluntary and gratuitous service thus rendered. The advantage of a sufficient gas supply for light, heat, and industrial purposes was emphasized, also the small cost of piping during the erection, as compared with the expense and possible inconvenience to the occupier if the installation was required and carried out after completion. Concrete examples of structures that had been completed without gas-service, and the inconveniences incidental to the subsequent furnishing of them were kept in hand, and used with discretion. If the matter was properly worked, they seldom failed to attain the result desired; but if every endeavour failed, the building would sooner or later come into line as one of the examples. If only half the information in the possession of gas undertakings as to the efficiency, economy, and safety of their product was known to all architects and builders, there would be little difficulty in the way of securing the adequate piping of all new buildings.

The men selected to serve on the "Architectural Service Bureau" should be specially trained, tactful, of pleasing address, familiar both with piping schedules and with the building industry, have some personal acquaintance with, and be capable of influencing and securing the confidence of, architects, and possess both patience and pertinacity. When a project had been approached, there should be no let-up until it was finally decided and settled. The activities of the department were followed up by advertising matter, folders, and advertisements inserted in the building magazines.

NEED OF A NATIONAL FUEL AND POWER POLICY.

Lecture by Professor Armstrong.

Members of representative Midland organizations had an opportunity at the University College, Nottingham, on Monday, the 11th inst., of participating in a discussion on the need of a national fuel and power policy, following the delivery of an address on the subject by Professor H. E. Armstrong, LL.D., F.R.S.; various aspects of coal supply and its utilization for the production of gas and electricity for lighting and motive purposes being dealt with. The assembly had been arranged by the Nottingham branch of the Society of Chemical Industry; and invitations to attend had been accepted by those associated with many other bodies. Dr. R. M. Caven, F.I.C., presided. A resolution had been tabled for consideration declaring—"That it is imperative without delay, by public effort and legislative action, to promote the development of a comprehensive national policy to govern the use of our fuel supplies, as the sole sources of heat and power, so that they may be used with the greatest effect, with utmost economy, and without creating nuisance, for the general good of the country."

Professor Armstrong, in the course of his address, declared that as a nation we are on our trial in every direction. Within the next few years we have to show that our past lack of receptivity is not innate, but the outcome of a false and narrow system of education, lacking all the elements of true culture. Without fail, we must raise up a new generation, and one that is alive to its opportunities and responsibilities. There must be far less so-called teaching and some real learning; effective training must be substituted for "parrot knowledge." We have long been told that our fuel supplies will suffice us but few centuries. Should supplies be still available in Central Europe when ours are extinct, our position will be a sorry one. If, therefore, we can look forward, and desire to retard our downfall, we must seek to conserve our supplies of fuel to the utmost farthing. Our policy has been hitherto one of drift, of "wait and see"—a self-condemnatory phrase. The question is, Are we to be too late in dealing with fuel and power problems?"

Suggesting the creation of a Central Fuel and Power Board, he said the first duty of such a Board would be to take stock of our national requirements and resources, and to excogitate a policy of meeting the former while utilizing the latter in the most scientific and economical manner possible. Without such a Central Board and national policy, it will be impossible to overcome the vested interests by which the path of progress is now blocked, and to avoid the colossal waste of money, and the still worse delays, that will be entailed if ignorance and the lawyers are allowed to intervene at every step. If we are to save ourselves, short and summary methods must be used; our national position being at stake. You have coal at your doors, but you make no proper use of it. Why is it not employed scientifically or economically? Why is no organized connection established between commerce, coal, gas, and electricity in your district? Why are you not provided with smokeless fuel? Why are you wasting so many good things which might be won from the coal you burn, if it were used rationally? There are two main directions in which we must move—the one being that of economy and conservation of our resources, the other that of public health and comfort. The two are coincident in many ways. It is well known that our methods of getting coal are in many respects inefficient; but our ways of using it are far more defective than our ways of getting it.

The discussion carried on of late in the Press with regard to dyestuffs has made the public aware of the special value of some of the products from coal; but owing to the rapid improvement and wide application of the internal combustion engine, and the present shortage of liquid fuel, we have been led also to suddenly appreciate the need we are in of developing our home supplies as fully as possible. Large quantities of liquid fuel may be obtained, especially by coking coal at relatively low temperatures; and we cannot well escape the moral obligation we are under to develop this source of supply to the utmost. It seems to be desirable from every point of view to submit coal to a preliminary carbonization, as not only are the liquid products of value, but the gas which is given off coincidently is of special value, and the residual coke has qualities which must eventually make it more popular fuel than any other at our disposal. It is unnecessary to speak at length of the value of gas as a fuel. It is daily becoming more popular with the public, and is also being more and more brought into use in manufacturing operations, not only on account of the ease and certainty with which temperatures can be regulated, but because of the cleanliness and saving of labour its use entails. Those who are unacquainted with what can be done with gas should visit Wolverhampton and some of the other towns in the South Staffordshire district covered by the Mond Gas Company. Over 160 firms are now supplied by this Company, and are using gas with complete success in a great variety of operations. We need only to develop the firing of boilers by gas, so that it may rank in simplicity and efficiency with coal firing under the best conditions, to make this form of firing universally preferred. The saving of coal transporting costs and of handling ashes would be very considerable, and would go far to meet the cost of piping and producing the gas. The greater ease with which the variation in the load factor can be met when gas is used is also a matter of no slight importance. There has been a continuous tendency hitherto to lower rather than to raise the quality of the gas. It will be necessary to reconsider this policy, in view of the fact that the cost both to producer and consumer, and also the dimensions of the necessary mains, vary inversely rather than directly with the quality. It would obviously pay to deliver benzene vapour alone, if this were practicable. I have always myself advocated the supply of a rich rather than of a poor gas. The point is of importance, because in coking coal at a relatively low temperature the gas produced—say, 5000 to 6000 cubic feet per ton—is of high calorific power. Until gas heating apparatus has been more developed, and the whole subject placed upon a proper scientific basis, it will be premature to come to any final conclusion with regard to the quality of the supply that is most desirable. Probably it will be found to vary as the possibilities in different districts and the requirements vary.

The problem which most nearly concerns the general public at the moment is that of coking coal, so as to produce a satisfactory smokeless fuel. Such a fuel cannot be much longer withheld. The gas engineer has been the main cause of the delay; and his primary fault is that he has obviously neglected the chemical side of the industry. Being as a rule brought up in the works, and saturated with the prejudices of past generations, he has but one object in view—the production of the maximum volume of gas per ton of coal carbonized. The coke produced under such conditions is necessarily a hard one, which burns with difficulty. Unfortunately, the technical journals have systematically written-down all attempts to produce a soft coke suitable for general consumption. All the coking plants in operation in the country have been designed either by Belgians or Germans, and not a few are of foreign construction. There is no reason why we should not do such work entirely ourselves; but the problems will not be solved until chemist and engineer are brought into fruitful conjunction. In the past, attempts to produce a satisfactory smokeless fuel have been attended with unfortunate results; but I am satisfied that the ultimate verdict will be that the public owe much to those who have been pioneers in the cause. Mistakes were made; but there has been gradually evolved a satisfactory plant, which will be in operation, if not before the year closes, at the very beginning of next. I know the details, and have no doubt of the ultimate success of the enterprise. The ovens carry a ton of coal apiece, and the charge is drawn and screened every eight hours; so that in a battery of eighteen ovens fully 50 tons will be coked daily.

The process of low-temperature carbonization is in no sense on its trial; only its minuter details are in process of evolution. It is useless to say we cannot warrant the success of the system. We can. The gas given off at low temperatures, though less in volume, is of far greater calorific power than that given off in producing blast-furnace coke; but the richness more than compensates for the lack of volume. It will bear dilution with 2·5 volumes of producer gas before it is reduced to a value of 300 B.Th.U. It is not proposed to use any of the gas in carbonizing,

but to fire the ovens with the producer gas made from the small proportion of coke breeze obtained in the process, and from cheap slack and washing refuse. I should say that only washed coal will be carbonized, in order to produce a coke of standard calorific value and low average ash content.

A 200-ton coking plant such as I have in view is expected to produce daily for outside use 5,600,000 cubic feet of gas (300 B.Th.U. calorific value), and 124 tons of a smokeless easily combustible coke. The amount of sulphate of ammonia obtainable will be from 20 to 25 lbs. per ton of coal carbonized. Taking into account that made from the producer gas, the daily output of sulphate should be nearly 4 tons. The gas will be scrubbed to remove benzene and similar hydrocarbons. The one uncertain asset of the industry will be the condensable liquid products, as the use of some of these has yet to be developed. But this asset is an adjustable one, as their character may be more or less changed by secondary treatment, if not directly by varying the conditions in the upper part of the ovens. I am of opinion, however, that, taking into account the great and increasing value of liquid fuels, the liquid products will be equal, and probably superior in value, to those produced either in gas making or high-temperature coking plants.

We are clearly under an absolute moral obligation to exercise the most rigid care and economy, in order that our fuel supplies may be conserved as long as possible. On this account, the utilization of everything in, or producible from, coal should be a first moral charge upon our nation. It must be ordered, at no distant date, that no raw bituminous coal shall be used, and that all such coal shall be first carbonized in order to abstract the volatile matters. As much as possible of the residual coke must be gasified, so as to utilize the nitrogen and recover it as ammonia. Gaseous fuel is clearly foreshadowed on many grounds as the fuel of the future for industrial purposes. Obviously, to develop a satisfactory programme it will be necessary to consider where and for what purposes the power will be chiefly required—to what extent it will be desirable to establish power-producing centres at the mines, to what extent relatively coal and coke shall be the solid fuels distributed throughout the country. We have to foresee the electrification of some of our railways, and the provision of electric power for canal use—a step of some urgency, in view of the importance of cheap carriage. Certain coals should be set aside for definite purposes—for example, Durham coal, perhaps, for the production of metallurgical coke. The best coking coals might be reserved for the production of smokeless fuel and gas. Each large town might coke as much coal as would be needed to produce the coke required locally by domestic consumers. Coke being the more bulky article, the carriage of coal will probably be more economical than that of coke. On hygienic grounds, the use of smokeless fuel is to be regarded as of primary importance; and great weight must be given to this consideration in dealing with coking processes. We can entirely prevent smoke, and yet make money.

Other points might be raised; but more than enough has been said to justify my thesis that the establishment of a National Central Fuel and Power Board, with full powers, at the earliest possible date, is a matter of Imperial consequence, and must be advocated in every possible way. The first duty of the Board would be to develop and establish a national programme, while carrying forward with despatch all necessary experiments which would conduce to the rapid introduction of improved practices. Coal should pay for inquiries relating to coal. In other words, I would urge that all costs should be met by a direct tax upon coal as raised from the pit.

In the course of the subsequent discussion, Mr. J. W. Ullett, the Manager of the British L. A. Ericsson Manufacturing Company's works at Beeston, speaking from the electrical side of the question, expressed his view as to the necessity of combination for combustion purposes in relation to gas and electrical supply. The resolution in the terms quoted was adopted.

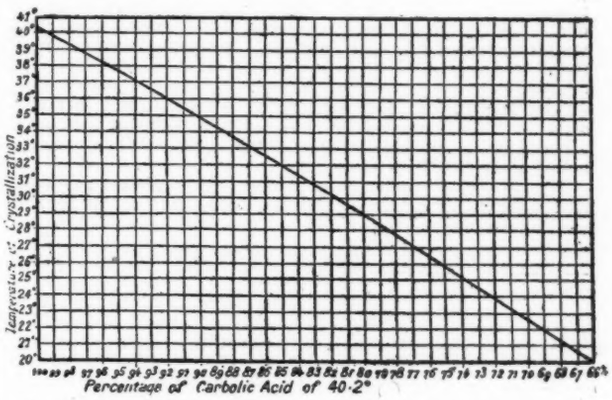
THE ESTIMATION OF CARBOLIC ACID IN CRUDE COAL-TAR PHENOLS.

A recent communication to the Paris Academy of Sciences by M. René Masse, President of the French Professional Gas Syndicat, and M. H. Leroux has dealt with the estimation of carbolic acid in crude coal-tar phenols. The following is a somewhat abridged translation of the paper of which the "Journal des Usines à Gaz," in reprinting it in a recent issue, makes mention as one of the many services rendered to his colleagues in the gas industry by M. Masse.

The crude phenols from coal tar, if properly prepared—*i.e.*, freed from naphthalene—form a mixture consisting of water, phenol itself (carbolic acid), ortho, meta and para cresol, xylenols, and other homologues, in addition to tarry substance of the phenol type. The chemical properties of phenol being so closely allied to those of the cresols, ordinary reactions such as those of the halogens do not serve for the estimation of the former. For example, the bromine process of Koppeschaar is applicable only to a mixture of phenol and ortho-cresol. On the other hand, an examination of the physical properties of mixtures of phenol and cresols has led to an analytical process suggested by a method mentioned by Duclaux and based upon the fractionation of the liquids.

The boiling points of phenol and of ortho, meta, and para cresol under a pressure of 760 mm. reduced to 0° C. are respectively, 182°, 191·5°, 201·8°, and 201·2° C.; those of the xylenols also present fall between 220° and 225° C. All the boiling points were determined by using a Berthelot bomb and a Baudin thermometer, the whole of the stem of which concerned in the determination was immersed in the vapours. By concentrating the carbolic acid, by a preliminary operation, in the portions coming over below 203° C., by then rectifying the distillate and collecting that coming over up to 198° C., fractions of decreasing content of phenol are obtained. The quantity of phenol in each of these fractions can be judged by determining the crystallizing temperature of each. Commercial carbolic acid, the so-called 40-42°, has a solidifying or melting point a little above 40°. As will be shown in a later communication, for pure carbolic acid the figure is 40·85° C. (41° corrected); but in the valuation of crude phenols it is customary to express the result as phenol of 40·2°—the product usually supplied.

When addition is made to pure carbolic acid (of 40·85°) of either ortho cresol, or meta cresol $\frac{60}{40}$ (the liquid prepared by rectification, and containing 60 of meta cresol to 40 of para cresol), or, again, of a mixture of all three cresols, formed of 50 parts ortho and 50 parts of the $\frac{60}{40}$ meta-para, it is found that the temperatures of crystallization for the same content of cresols are very close, and particularly so when the proportion added is less than 33 to 100. The temperatures observed in these circumstances fall between 40·85° and 21°.



It also appears that the results are of the same character when the addition is made to carbolic acid of 40·2°; and the curve here reproduced gives the temperatures of crystallization of 40·2° carbolic acid in admixture with various proportions of a mixture of equal parts of ortho cresol and $\frac{60}{40}$ meta-para cresol.

Based on these observations, the analytical process, to be described at greater length in a further communication, is as follows: Three kilogrammes of the crude phenols are placed in a still consisting of a copper globe of 4 litres capacity, surmounted by a Vigreux column of 60 cm. length. The distillation is adjusted to go on at the rate of 7 to 8 cubic centimetres per minute, and the distillate collected separately in three portions—viz.: (1) Water and phenols coming over up to 180° C.; (2) liquid obtained from 180° to 203° C.; and (3) about 100 cubic centimetres distilling above 203° C. To the portion No. 1 is added sufficient sodium chloride solution (35 per cent.) to precipitate the dissolved phenols. The latter, after decanting off the liquor, are added to No. 2, and the whole placed in a still of suitable capacity. The vessels which contained these bodies are washed with No. 3, and the wash liquors added to the contents of the still.

Rectification is carried out with the column previously employed, and fractions of from 250 to 300 grammes collected at the rate of 4 c.c. per minute up to a temperature of the vapours of 198° C. The temperature of the crystallization of each fraction is then determined.

An approximate indication is first obtained by rapidly cooling a small sample in a test tube. The experiment is then repeated, using 30 to 40 grammes of the substance contained in a small cylindrical vessel. It is left to cool slowly so as to obtain superfusion of from 1° to 2°. On then adding a morsel of carbolic acid, crystallization takes place and the temperature rises. The highest point registered by the thermometer is taken as the temperature of crystallization. If in the preliminary test the temperature is below 21° C., the fraction is enriched by the addition of sufficient carbolic acid of 40·2° to give a temperature of crystallization near to 25° C. By making allowance for the added carbolic acid, the actual content of each fraction is calculated.

The analytical process, although not claimed to be exact, nevertheless allows of the evaluation of a crude phenol to within about 1 per cent.—a degree of accuracy which it is hardly possible to exceed in the testing of a liquid of such mixed character.

THE CONTROL OF GAS-PRODUCERS.

By JOHN A. C. EDMISTON, of Motherwell.

[A Paper read before the Scottish Junior Gas Association, Western District. Dec. 9.]

The question of increased working efficiency in all processes is at the present time engaging serious attention; and probably no department is of more importance than the generation of power, be it thermal or dynamic. Take the case of power-gas production, we find the control of gas-producers is commonly left in the hands of an unskilled man, who has had probably only a month or two tuition. The result is, when anything goes wrong, and he is left to fight his battles alone, serious financial loss may result. He tries one thing after another, until he has in time put matters right, or the producer suddenly goes back to normal working. This he cannot account for. He is still in doubt, or probably indifferent, as to what was wrong. Consequently, when like irregularities again arise, he has still to resort to a hopeless rule-of-thumb practice to right matters. The fact must be kept in mind that the control of gas-producers, particularly where varying qualities of coal are used, cannot be effected by other than scientific methods. I propose to review a few methods of control which I examined a number of years ago.

CONTROL BY GAS ANALYSIS.

One method commonly adopted is to rely on the chemical analysis of the cooled gas. Taking the case of a producer supplying heating gas direct and adjacent to a unit, we see at the outlet the sensible heat of the gas is ignored; yet we appreciate the importance of preheating the air for secondary combustion. We quite recognize the difference in luminosity of the producer gas generated from different bituminous coal, and also from anthracite. This is, of course, partly due to the presence of tarry matter, and partly to soot particles. Naturally, the analysis of the cooled gas gives no indication of these; neither does the analysis take any account of the aqueous vapour evolved from (say) a high oxygen coal, the heating value of which is purely sensible. The determination of the calorific value of the coal is a check on the oxygen content; but this is clearly no help in the actual control of the producer.

The following comparative analyses of producer gas from anthracite and bituminous coal show a similarity not in keeping with what would be expected from such dissimilar coals:

TABLE I.—*Analyses by Volume (Per Cent.).*

—	CO	H_2	$CH_4 - C_2H_4$	CO_2	N_2
Anthracite . . .	23·5	12·0	1·2	5·5	57·3
Bituminous coal .	23·0	12·0	2·5	6·5	56·0

It is understood now, however, that an analysis of cooled bituminous gas does not represent the actual composition of the gas reaching the furnace. Theoretically, gas made from bituminous coal containing 30 to 35 per cent. of volatile matter should contain 12 to 14 per cent. of hydrocarbons, or six times the quantity shown in the above analyses. The reason that the gas does not show such a content, lies in the fact that when bituminous coal is gasified, only a small portion of the hydrocarbons is converted into fixed gas; the remainder being evolved as tarry vapours, and passing as such to the furnace. This vapour is condensed in the apparatus for sampling, and therefore does not show in the analysis. Clearly, we have at least three main factors in the heating power of the gas—*i.e.*, calorific value of permanent gas, calorific value of the condensable tarry matter and soot, and sensible heat of the whole. How, then, can the analysis and calorific value of the permanent gas alone be a correct measure of the heating value of the producer gas, or an adequate means of control of the producer working?

It is obviously impossible to determine these main factors. We must seek the control in other directions, keeping continuously a record of the calorific intensity obtained in the furnace, and correlating this with the manipulation of the producer. The determining factors in the producer reactions, it is established, are mainly temperature of fuel-bed, aqueous saturation of the blast, and time-contact between air, steam, and incandescent fuel.

Low producer temperature or high aqueous saturation, or both, gives high carbon dioxide. High producer temperature or low aqueous saturation, or both, gives low carbon dioxide. Obviously, then, a record of the carbon dioxide content will be a valuable figure.

I found the "Bi-Metre" carbon dioxide recorder a convenient instrument for this purpose. It consists essentially of two simple meters, an absorption chamber containing slaked lime, and a water aspirator enclosed in a substantial metal case fitted with a window. A sample of the gas is drawn through the apparatus by means of the aspirator; and a simple pen mechanism registers on a revolving drum the difference in volume of the gas before and after the carbon dioxide has been absorbed by the slaked lime. There are no glass tubes, rubber, or other parts likely to become damaged by heat or rough usage. The action of the recorder is extremely simple and easily understood. The gas was filtered through moistened cotton waste, and then passed into the instrument; a record of the carbon dioxide content of the gas for 24 hours being obtained.

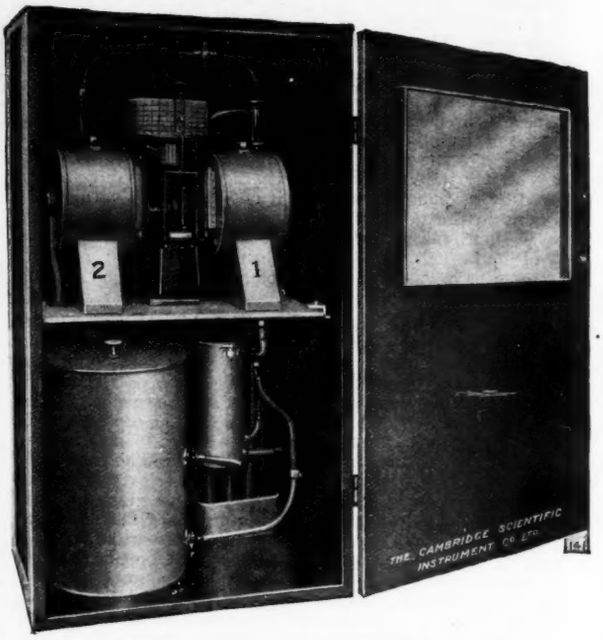


Fig. 1.—The "Bi-Metre" Carbon Dioxide Recorder.

For the record of the fuel-bed temperature, I relied simply on the eye, as the eye can perceive as small a variation of temperature as we are able to work to in practice. It approximated, in the condition set, to 1000° to 1100° C.

I have referred above to the sensible heat of the gas leaving the producer. This was determined by a platinum iridium couple in silica tube connected to a recorder giving 24 hours' record. The aqueous saturation was fixed by controlling the temperature of the air and aqueous vapour mixture passing to the fuel-bed. For this purpose, I used an "H. & M." thermograph in each producer blast-pipe. This instrument consists essentially of a steel bulb connected by a length of flexible steel capillary tube to a special form of Bourdon spiral. The whole system is filled with mercury; and changes in temperature of the bulb give rise to corresponding changes in pressure in the system, which are magnified and recorded by means of a simple pen mechanism in connection with the Bourdon spiral. The bulb is made in a number of forms and sizes to suit different requirements. The charts used are 9½ inches in diameter, and are clearly printed with uniform scale divisions, and read 0° to 500° C. The time-contact between fuel, air, and steam is determined by the blast pressure. This was measured by a manometer, which took the form of a U tube made of glass

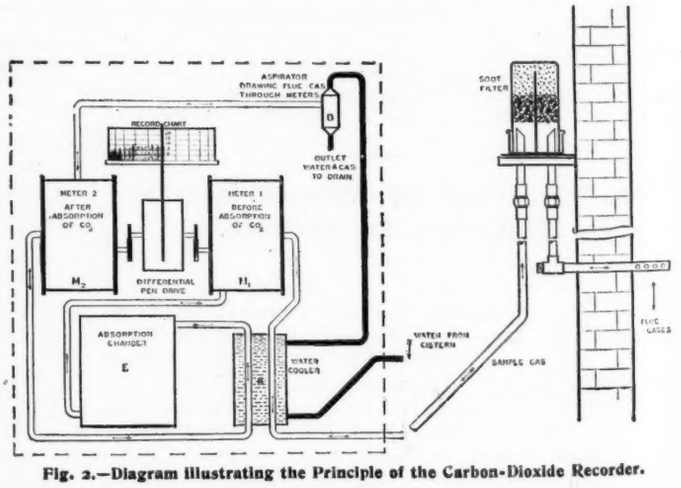
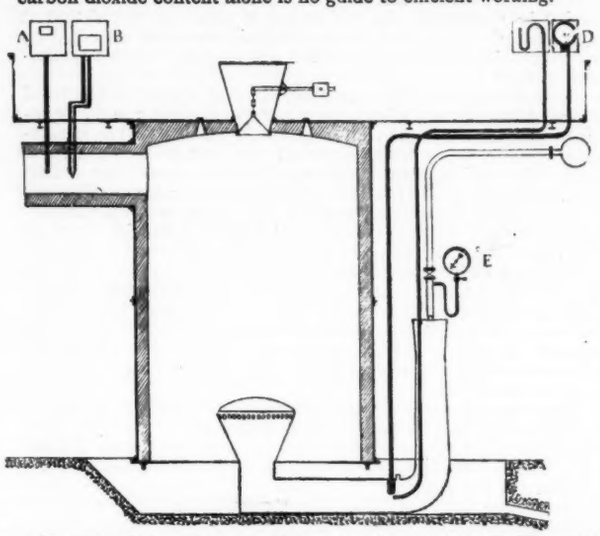


Fig. 2.—Diagram illustrating the Principle of the Carbon-Dioxide Recorder.

½ inch bore, filled with colored water. Down the blast-pipe was an iron tube of similar size, and bent so that it could be easily passed down through the orifice. This was connected to the manometer, which was mounted on a board with square paper (ten squares to the square inch), to read the difference in levels.

The Coal in the Producer.

In practice, I have found that a great deal of trouble arises from the quantity of ashes at the blower; and if the bottom-man removes the ashes at irregular intervals, or takes away too much at a time, poor gas results. Some ash or clinker should be retained above the blower, to preheat and assist the decomposition of the aqueous vapour and air. If too much is present, back-pressure results and lowers the amount of blast passing through the producer. As the steam pressure and size of nozzle are constant, air alone is reduced; and consequently the saturation of the blast rises, and the temperature of the fuel-bed falls. This is at once indicated by the carbon dioxide content of the gas increasing, and by the manometer pressure rising. If too much ash is removed, the blower becomes enclosed in fuel, and then offers less resistance to the passage of the blast. The steam-nozzle, while still giving a constant quantity of steam, forces more air into the producer, and thus the aqueous saturation falls. This results in intense temperature at the blower, damaging it, and also in the fuel-bed being shallower. There is not now, with the increased air and aqueous vapour velocity through the fuel-bed, sufficient time-contact, and so the carbon dioxide content of the gas rises. Both these sets of conditions thus give rise to increased carbon dioxide; and hence carbon dioxide content alone is no guide to efficient working.



A. Carbon Dioxide Recorder. B. Thermo-Couple Recorder. C. Manometer Gauge. D. Blast Saturation Recorder. E. Steam Pressure at Nozzle.

Fig. 3.—Arrangement for Determining Steam Pressure at Nozzle.

Clearly, then, consistency in depth of fuel in the producer is of prime importance; and so regular charging (say, about 1½ cwt. to 2 cwt. at one time) and removal of ash must be maintained; otherwise there will be irregularity in the delivery of gas. If a large quantity of coal is charged into the producer at one time, there is likely to be a sudden evolution of gas; and since the dampers controlling the admission of the air of the secondary combustion in the furnace cannot be regulated every time the producer is charged, there may be at such period an excess of gas in the furnace, which will go up the chimney unburned. Between the chargings the quantity of gas generated decreases; and there may then be an unnecessary excess of air in the furnace, carrying off heat.

The bed of coal in the producer must be kept level; otherwise the air seeking the channel of least resistance will pass through the thinner parts, generating a poorer gas, which often carries an excess of carbon dioxide, and varies in its composition. The bell-and-hopper feed, which is generally used, to a certain extent distributes the coal over the bed in the producer; but its action is intermittent, and depends entirely upon the attendant. Uneven distribution can, of course, be remedied by poking; but this involves labour, which is often shirked. The coal in the producer must also be poked to break-up the cakes and lumps, and thus preserve a uniform flow of gas. With the introduction of mechanical feed for gas producers, which has now been employed successfully in practice, there is a more uniform gas; while labour has been reduced, because of the smaller amount of poking required. Much damage may be done to the bed of fuel by over-poking, and the same can be said of insufficient use of the poker.

The Quality of Fuel.

The quality of fuel is a very important item in gas production. Plants have been erected for the gasification of a good fuel, and at some time or other it is attempted to gasify a much inferior class, with the result that either the plant or the fuel is condemned. I have found that it is best first to determine the fuel to be gasified, and then to design the plant accordingly.

When this routine of manipulation has been carried out, the record of carbon dioxide content and manometer pressure of air-steam blast temperature will furnish an exact guide to the control of the producer working. Table II. is a record of four weeks' control, principally on this system.

Summary.

The first week the producer attendants were allowed to work as they had been in the habit of doing. The second, third, and fourth weeks they were asked to work according to the following figures. Temperature of saturation of blast to be 45° C. The manometer or blast pressure to be not more than 9-10ths inch. Pressure of steam at the nozzle to be not more than 35 to 40 lbs. per square inch. The arrangement for determining the steam pressure at the nozzle is shown in fig. 3. The stop-valve had fitted on the outlet end a steam pressure-gauge, which indicated pounds per square inch up to 70.

The temperature of saturation of the blast at 45° C. gave the smallest amount of clinker, which is a very great consideration, on account of the large number of coals that have a fusible ash. This temperature also gave the necessary temperature at the zone of combustion to ensure the minimum amount of carbon dioxide in the gas. The blast pressure, 8-10ths to 9-10ths of an inch, gave an indication of the height of fuel and ash in the producer, and caused the least trouble to the attendants. In general, it is seen that high manometer pressure corresponds with high carbon dioxide and high blast temperature.

A producer may be worked with varying temperatures at the top of the fuel-bed, from (say) a dull red to orange, depending on the intensity of the temperature required in the furnace. Low top temperature gives a gas richer in hydrocarbons and a higher furnace temperature. Furnaces heated with gas from bituminous coal should be adjacent to the producer, to avoid deposition of the tarry matter and soot, which have heat value.

I have not attempted to deal with the scientific question. The paper is brought forward with the view to explaining the system of control which I have found to give the best results. It must not be taken that these figures can be applied to the production of any quality of gas; but, as stated above, the proper working constants must be first determined. All the information is at the eyes of the producer attendants, so that they have first-hand details regarding the running of the producers under their control; and it requires no chemical assistance, once the working-constants have been determined. This method I have found quite satisfactory for controlling the heating in copper and zinc smelting furnaces; and I am confident it will apply equally well in any industry using bituminous gas-producers.

DISCUSSION.

Mr. John Frazer (Dalmarnock) said he had had a good dea of experience with gas-producers at the Provan and Dawsholm Gas-Works; and he agreed with the author that the ordinary methods of working were oftentimes very haphazard. On the other hand, he had seen the experiment tried of regulating the air supply to what was theoretically necessary, with disastrous results. He was surprised to note the position of Mr. Edmiston's steam-pressure recorder. He had found the regulation of steam pressure very difficult, until reducing valves were put on, bringing the steam

Table II.

	First Week.							Second Week.						
Average . . . . (Days)	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.
Carbon dioxide per cent. by volume.	8·6	7·2	9·6	6·2	5·4	4·8	7·5	4·9	7·9	6·5	4·9	4·7	4·9	5·0
Temperature of saturation of the blast . . .	49·5° C.	48° C.	51° C.	47·5° C.	46° C.	45° C.	48° C.	45° C.	49° C.	48° C.	45° C.	45° C.	45° C.	45° C.
Blast pressure	1 3/10"	1 1/10"	1"	8/10"	7/10"	8/10"	1"	8/10"	1 5/10"	1"	7/10"	8/10"	8/10"	8/10"

	Third Week.							Fourth Week.						
Average . . . . (Days)	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.
Carbon dioxide per cent. by volume.	4·5	4·7	4·6	4·6	5·1	4·9	4·9	4·5	4·9	4·7	4·5	4·7	4·8	4·6
Temperature of saturation of the blast . . .	46° C.	45° C.	45° C.	45° C.	46° C.	45° C.	46° C.	45° C.	45° C.	46° C.	45° C.	45° C.	45° C.	45° C.
Blast pressure	1"	8/10"	7/10"	8/10"	7/10"	7/10"	7/10"	7/10"	7/10"	7/10"	7/10"	8/10"	8/10"	8/10"

pressure down from boiler pressure, which was nominally 150 lbs. per square inch, to a constant 100 lbs. per square inch.

Mr. JOHN WILSON (Greenock) was surprised that Mr. Edmiston should speak of designing his producers for one class of coal.

Mr. WILLIAM BENNETT (Greenock) said that, as the amount of clinker affected the composition of the gas, the composition would of necessity vary continuously between the times of clinkering. Would not a constant flow of steam be more desirable than a constant pressure, and would it not be better to use mechanical means for clinkering? He did not think it an advisable thing to judge temperatures by the eye, as a hot body would not seem so red in daytime as at night. He too would not like to rely on getting coal of constant quality.

Mr. EDMISTON, in reply, remarked that it was well known that the steam pressure should be as low as possible; and the gauge was fitted to be a check on the men. Steam was supplied to him from the boilers at 120 lbs.; and he reduced it to 70 lbs. in the main supply-pipe to the producers. Varying pressures gave great trouble, and bad gas. As regarded designing plant for one quality of coal alone, a good many large works drew their supplies from one pit. But he did not consider the quality of the coal mattered as much as the amount of ash in it. He did not think it advisable to set a regular time for clinkering. He believed in having the clinkering carried out when the gauge rose to some predetermined point; and the figures given at the end of the paper were obtained while working under such conditions. As to judging temperatures by the eye, anyone accustomed to it could set to within 20°; and for all practical purposes, within 50° was, he considered, quite accurate enough for gas-producers. The frequent breakdowns in mechanical plant had put them out of favour for clinkering.

Mr. FRAZER said he was sorry he could not see eye to eye with Mr. Edmiston as to clinkering and steam pressure. The producers ought to be cleaned regularly, especially where three shifts were worked; otherwise there would be very little success.

Mr. EDMISTON replied that he would never adopt any hard-and-fast rule, nor any regular intervals for clinkering. With regard to the position of the pressure-gauge, he had found it necessary, in order to have all the producers working at the same pressure, to fix it as shown; otherwise he found that the producer nearest the boiler drew the greatest amount of steam, to the detriment of the one furthest away.

YORKSHIRE JUNIOR GAS ASSOCIATION.

Inspection of the New Wortley (Leeds) Gas-Works.

The members of the Yorkshire Junior Gas Association, despite a railway service disorganized by fog, turned up in strong force last Saturday afternoon, to inspect the New Wortley Gas-Works of the Leeds Corporation, which are under the management of Mr. R. N. Webb.

Mr. A. EDWARDS, the Chief Chemist to the Leeds Gas Department, at the outset, apologized for the unavoidable absence of Mr. Leach, the City Gas Engineer, who was in charge of a party of engineers who were visiting the Meadow Lane works. Mr. Edwards had further to apologize for the fact that a part of the intended programme would have to be abandoned—that of the inspection of the new telpher coke plant—owing to a fire which had broken out, through internal combustion.

The visitors, in two parties, were then conducted round the toluol plant by Mr. Edwards and his assistant, Mr. F. Firth. The guides explained that the plant was not in the position which would have been chosen had there been more space available. The plant was Government provided, in accordance with the needs of the Ministry of Munitions. They had been handicapped by the formation of the gas-works as a whole in finding a suitable site for the new plant (which is rather less than a year old). The works are divided into two by a road. On the toluol plant, there were two Holmes brush washers of the vertical type. The process of oil-washing is very simple. There are two washers and three wash-oil cellars. The scrubbers are of the ordinary brush rotary type, exactly as most of those present were accustomed to use for ammonia scrubbing.

The plant as a whole is the work of Messrs. Simon-Carvès. The visitors were reminded that when the Ministry of Munitions had to put up these plants in various works in the country they went to the coke-oven and bye-product people, and asked them for estimates of the various requirements and percentages. These were given; but nearly every plant had been hopelessly out in its estimation of the quantity of steam and cooling water required. The reason for this was clear. Most of the plants had been hitherto at coke-oven works, where they usually had a more or less unlimited supply of steam. There had been no conception of the amount of steam such a plant as that at the Wortley Gas-Works would really require. At colliery plants, also, there was usually water passing in huge volume; so that the coke-oven people had an almost unlimited supply of water.

At Leeds, when they found they were not able to pump enough water, they had arranged for the use of the town supply. After a month's working, they found that their bill for water was staggering. It just about doubled the cost for benzol recovery of all the other items put together. The steam and cooling water difficulty was a serious one. It was one of the points on which the Leeds people were able to speak from very bitter experience. The visitors viewed with interest a handy makeshift method of utilizing water to the best advantage. A considerable volume of water is obtainable from the tank of a disused gasholder, which is partly used now as a tar-store. After using the water for cooling, it is returned by overhead pipes to the old gasholder, where, at some little height, it is sprayed through the air and further cooled in falling over the wide surface of the old gasholder roof before it drops back into the tank, to be used again.

Particular attention was drawn to the problem of naphthalene. When they at Leeds had been asked to oil-wash, they had at once thought about troubles which might occur due to the effect of washing; and that of naphthalene in the distribution service was quickly regarded as the most serious. The condensing arrangement, which was split up into two parts, was an endeavour to side-track the naphthalene. They frequently condensed the vapours coming from the top of the still in the primary condenser, and brought down at that point most of the creosote together with most of the naphthalene. This was run to pans outside the building, where the oil cooled and deposited the naphthalene in the form of white crystals, which could be shovelled away, and the remaining oil then run back. They found that they did get a condensate which contained a great deal of the naphthalene, though not all; and this portion was rejected, being passed to the outside on to trays on which it cooled into crystals. By this means it had been found that at least half of the content of naphthalene from the oil could be secured. Even this, of course, did not altogether cure naphthalene trouble.

It was stated that when the plant was first started and rectified benzol produced, no effort was made to take out the fore-runnings—the unsaturated hydrocarbons and paraffins. The unsaturated hydrocarbons which attacked the acid produced a thick pitchy-like stuff known as acid tar, which was very difficult to deal with. There had also been trouble with emulsification. This had had to be attended to, and none of the trouble was now experienced. After the sulphuric acid had been agitated for about an hour, and it was desired to wash with water, the benzol should not be agitated with water. The water should be allowed to run through the benzol scrubber as a shower till it ran clear of the milky appearance. They could then give an agitated wash with water without fear of the benzol mass emulsifying. This, it was claimed, was a tip which would save a lot of trouble. After the alkali wash, it was always advisable to use the still water wash to take the alkali out.

Proceeding to examine the analyzers and condensers, and to have a look at the products just being delivered from the two stills, the whole sequence of process was detailed. To obtain a good separation of the undesirable unsaturated hydrocarbons and paraffin from the crude oil, it was pointed out, a very good dephlegmator must be used. Mr. Edwards said he wished the parties to remember that what was being given was the experience of their plant. The plant was there to get out as much benzol as possible during the war. Whether or not it would be a good commercial proposition after the war was a matter which would have to be proved later. If the paraffin and other undesirable substance could be sold after the war, there would then be no reason to separate them by the slow means at present adopted. There was undoubtedly a great saving in the system on the plant in the use of acid, and in the ease with which washing was done.

There was one point which had cropped up lately. This was the question of corrosion, particularly of wrought iron in the still. Mr. Edwards said he had had occasion some time ago to take the top off the analyzer, and he found the heads of the water-tubes were most severely corroded in only about six months' working, and the interior of the tube was coated with rust scale. This was very serious; and it had been found in experience of that and other plants that it was confined to the still which handled washed products. There was practically no corrosion in the stills dealing with unwashed products. So far they had not found a clue to the cause of the corrosion.

Previous experiences of others had been of practical service in one or two points in connection with these plants. The whole of the coal-tar industry had been producing products which were not pure prior to the war. They were producing mixtures for industrial use, and had been doing so for years, and, of course, thought they could produce nothing else. Despite this former belief, however, the Government had been able to lay down strict composition requirements, and to apply them to the coke-oven people and the tar distillers as well as the gas men. He did not suppose that after the war there would be a complete return to the former impure products. There would be a demand for the more refined products.

Passing outside, the party were able to get a good idea of the way in which the plant had had to be crammed. The positions of the boilers and storage and other tanks were noted. Two wash charges were ready to go into the still at any time, it was mentioned. On the far side of line was a large store for petrol, which they were allowed to put back into the gas to replace products extracted. At the end of the meter-house was a tank for naphtha solvent, which was going to be a necessary part for every wash plant, because there would be very few plants which did not have the naphthalene difficulty once they got well going with oil-washing.

In the testing laboratories, it was shown that everything was done by the boiling point method rather than by the older control of the stills by the drop point method. A large still was

arranged in the laboratory for testing the distillation of crude oil, rich oil, or of any wash-oil, for estimating benzene.

After passing the Holmes washers, the party saw a system of controlling the efficiency of the washing by a battery of jet photometers and a couple of recording calorimeters. A series of connections ran around the wall of the room—one being of untreated gas, one of washed gas after being through the scrubbers, one of washed gas carburetted, and the fourth being the gas put on the town service. Four Bray No. 4 regulator burners indicated the strength of the flame. This method, it was pointed out, gave, by the simple means of the dark band in the flame in the luminous burner, a very reliable indication of the washing efficiency. Though there may be cases to which it would not apply, it would apply to anything up to 500 B.Th.U. gas.

When the party gathered in the offices at the end of the tour,

Mr. R. N. WEBB, the Works Manager, expressed his pleasure at the presence of the visitors, and the regret of the staff that part of the programme could not be carried out. He also apologized for the absence of Mr. Leach. Most of those present might be aware at the Wortley works they had been having a fairly rough time lately with fires. They had had to stack, at the commencement of the season, a tremendous amount of wet slacks. They all knew the risk in doing this, and he could assure them that it would not be done again at that works, if it could be helped. Down one side of No. 1 retort-house—now disused—there were stacks of this wet slack; and they were engaged in pulling down the old direct-fired type of benches. By internal combustion the wet slack had caught fire, and the heat had travelled through the retort-bench to a large stack of cannel coal down the other side; and set that on fire. They had about 9000 tons of slacks stocked; and last week they found it steaming. The fire had got right in the middle of the stack. He would very much have liked the party to have seen the telpher plant, and particularly the screen, which was novel. It worked horizontally. They would be glad to see the Association there again some time under better circumstances, when the telpher plant and screen would be working in good style.

The PRESIDENT (Mr. J. Lister Cooper) said the afternoon had been extremely instructive; and they were indebted to Mr. Leach, Mr. Edwards, Mr. Webb, and Mr. Firth, and offered their thanks. They had seen what was perhaps one of the earliest benefits which had been derived from the war—a realization of the old proverb that necessity is the mother of invention. In the past they had given Germany the benefit of their tar products very considerably, and now, largely due to the untiring and skilful efforts of men like their hosts that day, the nation and the industry were finding things out.

Mr. CHAS. ROPER having seconded the vote of thanks,

Mr. E. GARSED, in support, said it had been more than a works' visit—it had been a works' lecture.

Mr. EDWARDS, in a brief reply, on behalf of Mr. Leach and his colleagues, said they were glad to have been of service. The subject was a new one, and as such it had its interests; and if they had been able to give any useful help to gas engineers in the need of the time, they were very welcome to it.

THE WEDGE OPTICAL PYROMETER.

There are several advantages claimed for the "Wedge" patent optical pyrometer which should entitle it to consideration in connection with the very many cases in which ready means—without any complications such as may lead to confusion in the hands of comparatively inexperienced men—are desired for ascertaining heats in high-temperature operations. In the first place, it is undoubtedly simple in construction, and is complete in itself, and free from accessories. No preliminary adjustments or comparisons are required, so that it can be used both easily and quickly. The instrument is, in fact, extremely portable and uncomplicated, and altogether of such a character that there need be no hesitation in placing it in the hands of a foreman or intelligent workman.

This pyrometer can be employed in any case in which the heated body is clearly visible, either directly or by reflection, and shows a distinct coloration; and with it, it is said, after half-an-hour's practice, such a man as has just been referred to will be able to estimate any temperature within the range of the instrument to 10° or even 5°. It is calibrated to cover any range of temperatures desired, between the limits of 500° and 2100° C.; a single instrument, with the scale divided in intervals of 20°, being arranged to cover a range of 400° C. For those cases in which a greater range of temperature-reading is required in a single instrument, one can be arranged to cover 800° C.—the scale being then divided in intervals of 50°—so that a pair of instruments can be made to cover the temperature range quoted, from 500° to 2100° C.

The instrument consists of a brass tube, furnished with a small telescope so arranged that the objective of the telescope focuses the image of the heated body on a movable prism placed inside the tube. The eye-piece of the telescope then reveals to the observer the magnified image on the prism. A suitable shield is provided to prevent exterior light reaching the eye; and at one side of the tube is a milled head, actuating a rack and pinion, which moves the prism through the field of vision. The prism is made of specially prepared dark glass, so arranged that it cuts off the light emitted by a heated body at various temperatures. The operator, looking through the instrument at the object of which he desires to know the temperature, turns the screw, so that the thicker part of the prism comes gradually into the field of vision. The object appears to be gradually a darker and darker colour, until at a point giving the actual temperature the colour entirely disappears. The pointer on the scale at the top of the instrument will then indicate what this temperature is.

The makers point out that naturally a little practice is required to decide the exact moment when the colour disappears; and here, of course, the practised eye of the operator comes into play. The first readings, they say, will probably be to within 20°, and afterwards to 10° or less.

The "Wedge" optical pyrometer was invented by Messrs. Cochrane and Co., of Middlesbrough, for use in their own works; and the firm's expectations in regard to its utility having been fully realized, the pyrometer is being manufactured and sold under licence from them by the Optical Pyrometer Syndicate, of Nos. 182-183, Temple Chambers, London, E.C. Each instrument sent out is calibrated by the inventor himself.

Restrictions on the Use of Copper.

Orders have been made, dated the 8th inst., by the Minister of Munitions, under the Defence of the Realm Regulations, prohibiting the use of copper, in any kind of manufacture, except for the purposes of a contract or order for the time being in existence certified to be within Clauses "A" or "B" of Circular L. 33 as to control of output, issued by the Minister of Munitions on March 31 last. The order as to restrictions on dealing in copper states that no person shall buy, sell, or, except for the purpose of carrying out a contract in writing existing prior to such date, enter into any transaction or negotiation in relation to the sale or purchase of copper of any class, whether wrought or unwrought, situated outside the United Kingdom, unless such person is authorized by a special permit from the Minister of Munitions to purchase or sell the same. All persons, except as mentioned below, shall send in to the Director of Materials, Armament Buildings, Whitehall Place, not later than Dec. 16, returns of: (*a*) All unwrought copper held by them in stock or otherwise under their control, (*b*) all unwrought copper due for future delivery to them, and (*c*) all contracts existing for the sale to, or purchase by, them of unwrought copper at the above-mentioned date. Notwithstanding the above, no return is required from (1) any manufacturer or smelter of stock in hand or due for future delivery for the sole purpose of manufacture or smelting at his works, or (2) any person whose total stock in hand and due for future delivery does not exceed 2 tons.

Economy of Gas for Bread Baking.—The recent convention of bakers would, says the "American Gaslight Journal," do well to study the work done in Denver as regards reducing the cost of bread making. These bakers have claimed that it costs them 15 c. per hundred loaves for fuel, whereas in Denver one bakery is turning out a hundred 10 c. loaves baked by gas for a fuel cost ranging between 8 c. and 9 c.

Control of Railway Waggons.—It has been announced in a supplement to the "London Gazette" that the Defence of the Realm Regulations have been amended so as to include the following: The Board of Trade may, for the purpose of making the most efficient use of railway plant or labour with a view to the successful prosecution of the war, make orders for all or any of the following purposes: (*a*) For enabling the Board of Trade to take possession of any private owners' waggons, and to use those waggons in such a manner as they think best in the interests of the country as a whole, on such conditions as to payment, use, and otherwise as may be provided by the order. (*b*) For enforcing the prompt loading or unloading of waggons, by making failure to load or unload in accordance with the order an offence. (*c*) For curtailing any statutory requirements as to the running of trains or affording other facilities on certain lines or at certain stations. (*d*) For restricting or prohibiting certain classes of traffic.

Industrial Engineering.—As the subject of his Presidential Address on Monday of last week to the Junior Institution of Engineers, Mr. F. W. Lanchester, M.Inst.C.E., took the present position and post-war outlook of industrial engineering. He pointed out that in a rapidly growing number of trades the technical soundness depends ultimately upon the industrial engineer. It may be shared with specialists in different directions. The chemist, the biologist, the bacteriologist, the metallurgist, all may have their part to play; but it is rarely that the industrial engineer has not his load to bear in the total burden of responsibiiity, and his share of the burden increases with the expansion of our national industries from year to year. To admit—as all must admit—the importance of our supremacy in industry, is to admit the importance of studying and fostering those qualities which tend to the making of the successful engineer—self-reliance and quickness to overcome difficulties and obstacles. Full consideration was given to the economic outlook and the labour problem; Mr. Lanchester expressing the opinion that great benefit would result if the economic side of the question were understood clearly by those upon whose brains and skill the future of our industries so largely relies. If, he said, the manual worker is to have an increase in his pay, rather than profit-sharing, it should be on a piece work or bonus system, where individual effort gives individual recompense.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Ammonia and Steel Tubes.

SIR,—The explanation of the "contrary experience" to which Mr. Bernard P. Bezant refers in his letter of the 6th inst. is not, in my view, far to seek.

It is hardly the action of ammonia, as such, which produces the corrosive effect on steel tubes. Vesicles of ammoniacal liquor (particularly if the oil-washing is effected prior to the removal of the ammonia from the gas) are mechanically associated with the benzolized oil. On distillation of the latter, the ammonium sulphide and ammonium bisulphide of the ammoniacal liquor are decomposed, sulphuretted hydrogen is released, and under certain conditions of temperature rapid destruction of steel tubes ensues.

Anhydrous and liquid ammonia are singularly free from sulphides. Hence the absence of sulphuretted hydrogen—the important contributory factor of the corrosion in question.

Experience of the manufacture of liquid ammonia certainly confirms the above explanation. Steel tubes used for the application of steam heat in the stills for the desulphurization and decarbonization of ammoniacal liquor corrode in a few weeks; but the steel cooling coils used in the ammonia absorbers of a liquid ammonia plant serve almost indefinitely.

The presence of sulphides of ammonia and sulphuretted hydrogen in the one case, and their absence in the other, is undoubtedly the explanation of the phenomenon.

Gas and chemical engineers must not quarrel with Nature; rather must they seek to understand Nature's most insidious and furtive moods.

P. PARRISH.

South Metropolitan Gas Company's Chemical Works, East Greenwich, Dec. 14, 1916.

SIR,—The question raised by Mr. Bernard Bezant in your current issue is not only an interesting one, but also of great importance. He would be a bold man who would attempt to furnish anything like a complete answer to the problem propounded, as to "Why do makers of refrigerating plant use steel tubes, and not cast iron, and yet experience no trouble?"

The importance of the question of ammonia attacking steel coils in connection with the installation of benzol-recovery plants, either at gas-works or any other works, is well understood. It is more than likely it is something else which attacks the steel during the benzol, &c., extraction.

The whole subject is well worthy of the attention of the Institution of Gas Engineers; and if Mr. Bezant can secure any research work being undertaken by them, a public service will be rendered.

EDWARD A. HARMAN.

15, *New Street, Huddersfield, Dec.* 13, 1916.

Municipal Gas Profits and Income-Tax.

SIR,—I notice with interest your remarks, *re* Municipal Gas Profits and Income-Tax, and quite agree that in taking profits from municipally-owned trading undertakings great injustice is thereby done to gas consumers, among others.

Now the question of income-tax to be paid by municipalities is a subject very difficult of comprehension by the majority of members of town councils, and I am afraid your remarks do not help very much in the matter. A clearer understanding would materially benefit the members of many municipal bodies, and open the way for a more enlightened consideration of the whole question of the disposal of trading profits.

I am sure it would be most useful if information could be given in your columns by some well-known municipal accountant as to how the judgment of the House of Lords in the Leeds test case, delivered April 3, 1913, affects the payment of income-tax by individual trading concerns of a municipality, and what the collective effect is upon the finances of the municipality as a whole.

With this knowledge, I feel confident that most of the arguments as to large trading profits causing money to be lost to a town through income-tax would be found misleading, as would also the stronger argument, as you term it, of reduced profits enabling a corporation to evade income-tax.

My experience with income-tax assessment since the Leeds judgment leads me to believe that several members of the Stockport Town Council are not fully aware of the effect which this judgment has upon the total income-tax of the borough.

H. DAVIES, Engineer and Manager, Brighouse Corporation Gas Department.

Brighouse Dec. 14, 1916.

British Work and German Gain.

SIR,—Sorry would be the reading of a full analysis of the admissions at the Society of Arts in connection with Mr. C. M. Whittaker's paper on "The British Coal-Tar Industry."

In all the attempts to explain away why in two years a British firm has produced a certain dye (we will ignore the challenge of the German chemist that "No British firm could produce it in ten years"), the fact remains that the late Dr. Perkin himself dug down to bed-rock for a foundation, and thereon laid the concrete bases upon which German chemists built a great edifice, from which cumulative industry grew to enormous proportions, in trade, prosperity, and wealth.

A great British chemist's generosity thrown back, his goodwill destroyed, and the prospects of a stupendous industrial service devastated by sheer neglect and dilatoriness of a "wait-and-see" profession.

The same Germans, living then, and maybe to-day, when they heard that at Exeter the actual contents of a ton of coal were being approximated by increase in volume of gas 30 to 35 per cent., with no loss in illuminating power, and a much higher calorific value, came to this country, took away the truths, and immediately applied them to such an extent as, six or eight years later, to be able to re-assure us that there was "something in it," and vertical retort carbonization has possibly been supreme ever since. Results afford proof of this.

What induced the British chemist to produce a dye in two years which the German chemist declared no British firm could produce in ten years? It is a shameful answer—viz., war with Germany.

It is up against us—and severely too—to reward by our own work, instead of letting both go adrift.

L. S. T.

Dec. 16, 1916.

Mr. Nobbs Replies.

SIR,—In reply to the queries raised in your issue of the 5th inst., *apropos* of my recent lecture upon electric cooking, it is universally known among cooks or persons having to do with catering that there is a great loss in weight of meat cooked in gas or coal fired ovens. We are taught in cookery schools, and told in reference books, that the loss varies from 20 to 33⅓ per cent. or even more, and which is demonstrated in ordinary everyday practice.

I am aware it is possible to reduce this loss somewhat by very careful attention and manipulation of gas-taps, dampers, fires, &c., by paper bags and other contrivances to counteract this inherent disadvantage of a coal or gas oven. It is also possible to introduce automatic temperature and gas-pressure regulators with more or less success. But the cook will have none of them. Even thermometers (very useful aids to economy from the engineer's and the consumer's point of view) are voted a nuisance by most cooks.

To eliminate these troubles, and to promote harmony and economy in the kitchen, is a duty that all cooking and commercial engineers should strive to attain. The electric oven serves this purpose, as no "flame" fired oven can achieve by reason of its perfect temperature regulation. "A twitch of the switch" gives an exact and regular heat for all positions and at any time.

The electric oven is simplicity itself. It is safer, cleaner, more economical, and more convenient than "flame" cooking; it saves time and requires less labour; and the quality of the food is much improved—all of which means greater comfort and better health.

Your reference to presumably the smallness of the loss of meat in an electric oven as a "singularly amusing piece of bluff" is surely a platitude born of weary hours with a gas-oven.

As to the test made for the "loss of meat," it would be as well to point out that the lecture was given before a critical audience, whose chief business is to make and sell gas, coal, and steam cooking appliances, and to demonstrate to them among other essentials the extreme simplicity and economy of electric cooking.

To further the idea, the lady who undertook to do the cooking had never seen an electric range before, with the exception of a two hours' trial run to test the temperature of the oven a couple of days before my lecture. During the lecture she had no assistance whatever from me; and there were other factors to contend against a small "loss of meat"—viz.: The comparatively high temperature that had to be used to roast the meat well during the short time my lecture lasted (3 to 5 p.m.), and the "platform nervousness" of the lady.

The temperature was read from a 4½-inch scale mercurial thermometer attached to the oven door, the bulb projecting 2 inches into the oven (the actual temperature in the centre of the oven would be about 30° Fahr. higher than the door thermometer). The temperature at the start (3.10 p.m.) when the meat was put in was 400° Fahr. Full heat was kept on for ten minutes, and the temperature rose to 430°. The switch was then turned to quarter heat, and the temperature gradually fell to 320° by 4 15, when all the current was turned off and the joint allowed to continue cooking by the stored-up heat in the oven. The temperature then gradually dropped to 280° by 4.35, when the current was switched-on to full heat to brown up a chicken that had been put in the oven while the meat was roasting. The joint was removed at 4.45 p.m., and weighed, when a loss of only 11¾ per cent. was recorded. It might be noted that no blood or juices were to be seen in the drip-tin—only fat. No basting or turning of the joint was necessary during the cooking.

The party who purchased the joint declared subsequently that it was well cooked all through, moist, and delicious eating, and tasted much like a joint roasted in the old-fashioned way before a fire.

It will be seen from the above conditions that, even with high temperature and in inexperienced hands, an electric oven is simple and most economical to work.

C. GEO. NOBBS.

3, *Learmouth Street, Falkirk, N.B., Dec.* 12, 1916.

[The above letter is referred to in the "Electricity Supply Memoranda."—ED. J. G. L.]

An Appeal for Economy at Sheffield.—Mr. Hanbury Thomas, the Managing-Director of the Sheffield United Gaslight Company, has, on behalf of the Board, issued an appeal to consumers to curtail their use of gas. The reason, he says, for making this request, arises from the fact that a very large number of the Company's employees have joined the Colours; and notwithstanding repeated applications from the Company to the Ministry of Munitions, they have been unable to obtain sufficient men to replace them. The Company have the necessary plant to keep up the supply of gas; and it is only a question of man-power to enable them to do so. It is essential that the output of shells, &c., should not be endangered; and every effort will therefore be made to give a full supply to the munition works. But it will be necessary to reduce the pressure of gas in residential districts during the next week or two, or until additional men are forthcoming. The Directors rely upon the patriotism of their customers to put up with any inconvenience they may suffer, and to use as little gas as possible.

LEGAL INTELLIGENCE.

"IRONCLAD" GAS-MANTLES.

The action of *Curtis's and Harvey, Limited v. Bernstein* (otherwise Berney), trading as the East London Wholesale Mantle Company, was mentioned before Mr. Justice YOUNGER last Friday. Plaintiffs sought to restrain defendants (father and son) from representing in any manner that they were manufacturing, or authorized to manufacture, for and on behalf of, or as successors or representatives of, the plaintiffs, incandescent mantles of the kind formerly manufactured, and in fact still being manufactured, by the plaintiffs and known as "Ironclad" gas-mantles, or from doing anything which should lead to the belief that the plaintiffs had ceased to manufacture "Ironclad" gas-mantles, or that defendants were carrying on the business of such manufacture on behalf of, or in succession to, the plaintiffs; and from selling, or offering for sale, any gas-mantles not of plaintiffs' manufacture, under the name or description of "Ironclad" gas-mantles, or otherwise representing that gas-mantles, not of the plaintiffs' manufacture, sold by defendants were goods of the plaintiffs' manufacture.

Mr. CLAUSON, K.C., for plaintiffs, said the father had approached them a day or two ago, and he rather anticipated that he would appear in person.

Mr. JOHNSON EDWARDS said he appeared for Joseph, the father, and desired an adjournment in order that he might answer the affidavits, which he only got the previous day. He was willing to give an undertaking in terms of the notice of motion until over next motion day.

Mr. CLAUSON said he should not be surprised if the son did not appear, as he had not entered an appearance.

The second defendant (the son) said he appeared in person, and desired an adjournment to answer the evidence. He had not received a copy of plaintiffs' evidence, as he could not afford to pay for it.

His LORDSHIP told defendant he must at once enter an appearance at the Central Office, and suggested that plaintiffs' solicitors should supply him with a copy of the evidence.

The Solicitors agreed to do this; and the motion was ordered to stand over till Thursday.

Too Much Light at a Gas-Works.

At the Chesterfield County Police Court, Mr. Henry H. Everest, the Manager of the Whittington Gas-Works, was summoned for failing to screen an inside light. A police-sergeant stated that an incandescent light was burning on the gas-works premises on the night of an alarm; and when he requested the workmen to extinguish it, they refused to do so, saying they required the light to work by. The sergeant declared that the police had previously had trouble at this place. Mr. Everest said he was absent at the time; and he had no idea that the light was on. He had done his best in taking precautions for safety. A fine of £5 was imposed; it being remarked that there was no excuse for an offence such as this, when poor people had to pay heavily for breaches of the regulations.

Fined for not Answering Telephone Calls.

At the West Riding Police Court, Leeds, last Tuesday, before a Bench of Magistrates, Mr. Arthur Wormald, the Secretary of the Rothwell Gas Company, was summoned for failing to keep a person to answer the telephone in calls of emergency. It was stated that the defendant signed an agreement to have someone in charge of the telephone during certain hours. An operator at Rothwell gave evidence that she rang several times, but got no answer; and a police constable said that when he went to the works and ordered all lights to be extinguished—an order which was immediately carried out—he found the office door locked and bolted. The Chairman remarked that the Bench took rather a serious view of the case. The Company, apart from taking great risks themselves, endangered the lives of their workpeople. A fine of £10 would be imposed.

Melbourne Gas Light and Coke Company, Limited.

A petition asking the Court to sanction the confirmation of resolutions for the substitution of a modern Memorandum and Articles of Association for a Deed of Settlement of 1863, came before Mr. Justice Neville last Friday. Mr. Turner explained that the principal object of the alteration was to extend the area of the Company's operations, which were now limited to Melbourne in the county of Derby. They were not extending the character of the Company's business, but had added the usual ancillary powers, including power to borrow money, because under the Deed of Settlement this power was restricted to borrowing not more than £1000. They also asked for the usual power to increase the capital, as under the deed they could not increase the capital beyond £4000. His Lordship took exception to one clause in the memorandum, which enabled the Company to invest in other gas companies. On Counsel for the Company agreeing to drop this clause, his Lordship sanctioned the alteration.

Suspected Gas-Mantles at Salford.

At the Salford Borough Police Court, last Tuesday, before the Stipendiary Magistrate (Mr. Peter Wilson Atkin), James Holland, of Manchester, trading as the British Gas-Mantle Company, was summoned to show cause why three cases of mantles delivered at the Manchester Ship Canal Docks at Salford should not be forfeited and condemned. Mr. Frank Dart, who appeared for the Customs and Excise Department, said in February last the mantles referred to (valued at about £50) arrived at the docks from Rotterdam. They were detained, samples were taken and examined by experts, and the defendant was informed that the mantles had been seized on suspicion that they were of enemy origin, and that he must make a claim, and prove that they were not. He made the necessary claim, and produced a certificate of origin taken before the British Consul at Rotterdam. These certificates, proceeded Mr. Dart, were not to be taken as absolute proof that the goods were not of enemy origin. The regulations were admittedly very stringent. The claimant had to produce absolute proof of the origin of the goods; and it was only by this means that they could successfully work the blockade. There was no suggestion that the defendant had traded with the enemy; and it was very likely that he had been misled. But if people would trade with neutral countries in Europe, they did so entirely at their own risk. In the absence of the defendant or his Solicitor, the Magistrate made the order asked for, with five guineas costs.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Dec. 13.]

Nos. 17,349—17,767.

CAPRON, F.—"Production of neutral sulphate of ammonia." No. 17,648.

ETHERTON, S. B.—"Treatment of refuse liquors from gas and chemical works." No. 17,698.

EWEN, H. A.—"Electrically heated gas-jet." No. 17,433.

HALKETT, R.—"Natural-draught regenerative ovens and burners therefor." No. 17,455.

LARKIN, F. S.—"Adjustable flue-nozzle for gas-fires." No. 17,409.

LOCKWOOD, A. C.—"Gas-furnaces for cremating human remains." No. 17,618.

LOWE, J.—"Controlling gas-supply to gas-heated water-heaters." No. 17,608.

MEYER, W. H.—"Gas-fires." No. 17,429.

REYNOLDS, A.—"Manufacture of refractory bricks for furnaces." No. 17 397.

TATTERSALL, J. T.—"Building walls subject to heat." No. 17,693.

WELLINGTON, S. N.—See Etherton. No. 17,698.

WEST, J. & W.—"Retort-settings and retorts." No. 17,714.

The Welsbach Company's Scheme Approved in Germany.

We are informed by Mr. E. J. Butcher, the Secretary of the Welsbach Light Company, Limited, that advices have reached this country through the authorized channels to the effect that the German Government's sanction has been obtained to the provisional agreement of Sept. 29, 1916, between the Company and the Deutsche Gasgluhlicht Aktiengesellschaft, affecting the complete elimination of the German Company's interest in the Welsbach Company, and the sale, on favourable terms, of the Welsbach Company's interest in the Austrian Gas and Electric Company. In pursuance of the scheme of arrangement, approved by the shareholders and debenture stockholders of the Company at the meetings on Nov. 28, and by the High Court on the 5th inst. [*ante*, pp. 499, 549], it is intended shortly to offer to the shareholders and debenture stockholders for subscription 83,048 shares in the Company; the sanction of the Treasury to such offer having been obtained.

Price of Gas at South Shields.—Owing to the increased cost of labour and material, the South Shields Gas Company have decided to raise the price of gas 2d. per 1000 cubic feet.

Price of Gas at Swansea.—An intimated addition of 2d. to the price of gas to ordinary consumers at Swansea brings the charge up to 3s. 6d. per 1000 cubic feet. The increase has, of course, been necessitated by the enhanced cost of coal, oil, and other materials.

An Unsolved Asphyxiation Fatality.—According to the evidence given at a Leicester inquest, Horace Hutchinson, 22 years of age, had suffered from throat trouble, and some time ago fitted a patent heating apparatus to the gas-jet in his room. One morning the bedroom was found to be full of gas fumes; and the doctor who examined the body of the man attributed death to asphyxia. In returning a verdict to this effect, the jury added that there was not sufficient evidence to show how it came about.

Theft by a Gas-Works Employee.—At Ker Street Police Court, Plymouth, last week, Charles Mitchell, a coal wheeler at the Corporation Gas-Works, Devonport, was charged with stealing coal to the value of 9d., the property of the Corporation. A policeman said he saw the accused carrying something on his back. When asked what it was, he said it was a bit of coal he had got from the pit. He was taken to the police station, and coal was found inside the lining of his coat. It was stated that Mitchell earned on the average £2 a week. Mr. W. Priestley (the foreman of the gas-works) said he was a good workman; and he was willing to take him back, if the Engineer would consent. In fining the man £1, the Magistrates said they hoped the Engineer would take him back.

Deaths from Gas Poisoning at Plymouth and Devonport.—A family of four persons living in Desborough Road, Plymouth, were on Friday found dead from gas poisoning. The premises consist of a small shop with dwelling-house; and when the shop was not opened as usual in the morning, neighbours called the attention of the police to the fact. Entrance was made, and the whole place was full of gas. Upstairs were found the occupier John Skinner (aged 70) and his wife (aged 72) dead in one of the bedrooms; and in another, also dead, their daughter and granddaughter. The man was sitting by the side of the bed, having apparently been awakened, and got out before he was overcome. All the gas-taps were turned off. Workmen in the employ of the Plymouth Gas Company, under the supervision of Mr. P. S. Hoyte (the Engineer), and Mr. J. A. Richmond (Outdoor Superintendent), made an examination of the main in front of the house; and it is stated that a fracture was found. A man named Samuel Quantick (aged 67) was found dead the same morning in a bedroom at a public-house in Duke Street, Devonport. The room was full of gas, which had escaped from an old slide-fixture, from which the water had evaporated.

MISCELLANEOUS NEWS.

CONTINENTAL UNION GAS COMPANY, LIMITED.

The Ordinary General Meeting of the Company was held at the London Offices, No. 7, Drapers' Gardens, Throgmorton Street, E.C.—Mr. GEORGE A. TOUCHE, M.P., Acting Chairman, presiding.

The ACTING SECRETARY (Mr. E. C. Bode) read the notice convening the meeting, and afterwards the Auditors' certificate. The report and accounts were taken as read.

CHAIRMAN'S ADDRESS.

The CHAIRMAN, in moving the adoption of the report and accounts, said to those who had followed the fortunes of the Company since the war began, the report could contain no surprise. As expressed by a shareholder (Mr. Cave Orme) at the last annual meeting, their Continental interests were the bedrock of their prosperity. While these yielded no return, more than four-fifths of the Company's capital remained unproductive. After the gloomy story it was his duty to lay before the proprietors a year ago, no one could have expected any dividend from that source. The accounts of the Union des Gaz had not yet been published, though the Directors had hoped they might have had them before this meeting. But owing to the shortage of staff due to the calls of military service and other causes, this was not found possible. The Board, however, knew generally what the results were; and he would refer to their difficulties later.

MINOR INTERESTS.

Meantime, for the purposes of the accounts, the outstanding fact was that they related to minor interests only, representing less than one-fifth of the whole. In these circumstances the revenue was necessarily small—£8306, as compared with £9619 a year ago. The decrease was therefore £1312. This was due mainly to additional deductions for income-tax, and to the absence of a dividend on their shares in the Imperial Continental Gas Association. If the revenue was reduced, so also were the charges to profit and loss; and the management and general charges were less by £783. This was almost entirely due to a voluntary rebate on the Directors' fees. The Directors reduced their fees some years ago; and they made a further reduction in view of the fact that the shareholders were receiving no dividends. If fees were paid on the basis of work and anxiety, they should have been larger during the last two years than at any previous time in the history of the Company. There was also some saving in pensions; while income-tax was £2605, against £4392. This liability for income-tax was entirely due to the fact that under the system of average, one pre-war year was still brought into account. But for a recent concession, two pre-war years would be included. Next year the calculation would be made exclusively on war-period accounts. The net result was a profit on the year (excluding the carry-forward) of £3000, as compared with £1647 in the previous year. This £3000 profit, added to the previous profit and loss account balance, increased it to £23,301.

THE POSTPONED FRENCH DIVIDEND.

The balance at the credit of the revenue account, if available, would thus suffice to pay the dividend on the preference stock. He need scarcely say the Directors wished very much they could do so; but unfortunately the balance was not available. It had been the custom of the Company to include in the revenue dividends to be paid on the Union des Gaz shares. This was quite legitimate where the dividends were actually declared. The accounts for the year to June 30, 1914, included Union des Gaz dividends, amounting to upwards of £56,000. These dividends were actually declared in respect of that year; but, owing to circumstances which were fully explained to the proprietors a year ago, the payment of nearly £30,000 was afterwards postponed. That was the result of *force majeure*. They all regretted it. But it was the fortune of war; and it could not be helped. The French Company were having a terribly hard fight, and must husband their resources. As things had turned out, it would be folly to pay the dividend, although it had been declared. The shareholders of the French Company in general meeting had recognized the hard logic of facts, and had agreed to an indefinite postponement. This left the Continental Union Company in this position: Until the amount was received from the French Company, the credit to the profit and loss account of this Company was not available for distribution. It was little more than a decorative balance, which, if not dealt with, might be misleading. No balance on profit and loss account was available for distribution until the sum of £29,067 credited in 1914, but not received, had been provided for. The Board had therefore transferred the profit and loss balance of £23,301 to a foreign dividends suspense account. The same account was credited with £3656, being a rebate obtained on a readjustment of income-tax assessment under the provisions respecting companies prejudiced by the war. This was a rebate of a charge which was wholly in respect of foreign revenue, so it was a proper set-off against credit taken for foreign dividends. Here he should like to say that this satisfactory rebate had been facilitated largely owing to the clear manner in which the accounts had been prepared, and the ability with which the negotiations had been conducted, by their Accountant, Mr. A. Nops. By the aid of the two sums mentioned, they were able, in effect, to write-back £26,058 of the £29,067 formerly taken credit for, but not received, and which would never have been credited to revenue if they had known that it would not be received. There remained a difference of only £3000, which should disappear in the course of the current year. He should strongly advise that, in future, no revenue should be taken credit for in the profit and loss account unless and until received in cash. [Hear, hear.] This was the practice followed by some of the most successful Trust Companies. The fact that they did not credit the profit and loss account with dividends until received in no way prejudiced the claim of the proprietors to them.

CONTINENTAL INTERESTS.

The business of real interest in this Company was that of the Union des Gaz. Its affairs were managed from Paris; but the Directors had done what they could to assist them in the endless and difficult problems of coal supply. These problems had been threefold. There had been: First, the difficulty of overseas transport of coal supplies; secondly, the enormously increased costs; and thirdly, the difficulties in the way of obtaining anything approaching an increase in the selling price of gas commensurate with the increased cost. He proposed to make some observations on each of these three subjects; but he need not dwell on them at too great length, as he explained the position to the proprietors very fully a year ago.

DIFFICULTIES OF TRANSPORT.

First, as to the difficulties of transport. Owing to the shortage of shipping, the question of overseas transport had been one of constant and increasing anxiety ever since the war began. The very existence of the continental lighting business depended on it. In the early days of the war, it soon became evident that the only course open to the Company was to take ships on time charter. But it was difficult to get ships; and it was difficult to keep ships when they got them. No less than eight of the chartered ships were requisitioned by the Government; and many other steamers were requisitioned while negotiations were pending for their charter. He did not know that they could blame the Transport Department of the Government. Their task was a very heavy one; and everyone whose ship was requisitioned had special reasons to show why his particular ship ought not to be taken. Probably few had such good reasons as the Union des Gaz, because failure to maintain a supply of coal would have meant failure of gas heating and lighting in important cities in allied countries. This fact was placed clearly before the Government, and considered by them; and it was owing to their sympathetic attitude that the situation, bad as it had been, was not even worse. In addition to the boats lost by the requisition of those chartered, four had been torpedoed and sunk, and one, damaged by a mine, was delayed for six months, and its cargo was partly lost.

SHORTAGE OF TONNAGE.

He pointed out a year ago that shortage of tonnage was of far wider significance than any question affecting this Company. Its effect on the food supply of the nation was only now being realized. To an extent, shortage was unavoidable; but it might have been provided against in greater measure. Armed merchantmen had enjoyed relative immunity from the attentions of the "Apostles of Culture." The provision of guns and gunners for all ships ought to have been pushed with greater energy. [Hear, hear.] It should have been recognized that the old theory of sea warfare, which permitted of one gun in the stern for use when running away only, no longer applied. The cry was for more ships; and the need for more was very great. But one might well ask whether the best was being done: (1) To prevent loss of existing vessels, which was better than replacement; and (2) to get more effective use from the present tonnage. He put aside any question of tonnage lying deliberately idle, or carrying wholly inadequate cargoes. There was, he feared, a good deal of this in the early days of the war; but he was told there was little of it now. But there was still the question of quicker despatch at the ports. Any increase in the number of voyages of which each ship was capable was, in effect, equivalent to an increase of carrying capacity. Dock labour was greatly depleted by indiscriminate recruiting. Valuable time had been lost through congestion of shipping at certain ports. This, in itself, was equivalent to a loss of the use of tonnage. Efforts were being made to remedy this evil, by the formation of Transport Workers' Battalions and in other ways; but departmental officials were still prone to think of men in terms of numbers rather than of efficiency. The difficulty was not by any means restricted to this country. It had been serious at the ports of discharge, particularly at Genoa, where the delays had been a source of heavy expense. The country was promised more vigour in the prosecution of the war. He hoped the new Government would justify public expectations, and that, among other things, it would take steps to control the rapacity of neutral shipowners.

THE ENORMOUSLY INCREASED COSTS.

The cost of coal delivered at foreign ports had been simply calamitous. The price charged for coal itself had been high; but the disastrous factor had been the colossal freights. In June, 1914, freights were 7s. 6d. to 8s. a ton to Genoa. By June, 1915, they were 27s. 6d. to 35s.; having been 44s. earlier in the year. About the date of their annual meeting last year, they were 66s. After that they rose about 10s. a month till they attained the ruinous figure of 100s. in May last. A decline then set in; and from July to October, they varied between 70s. and 72s. 6d. These were the figures for Genoa; it had been much the same at Cette. To Rouen the rates had been: June, 1914, 6s. June, 1915, 23s. to 24s. June, 1916, 33s. But the Genoa shipments affected the Company most. Following on arrangements made between the British, French, and Italian Governments, a limitation price of 64s. 6d. to the Mediterranean had been agreed, as from the beginning of last month. Even this restricted rate was eight times higher than the pre-war charge. When dealing with hundreds of thousands of tons, the proprietors could easily imagine the disastrous effect of such an increase. The price of 35s. a ton had been charged for coal; but, under the same arrangement, the future charge had been fixed at 25s. for exportation to allied countries.

DIFFICULTY OF OBTAINING ANY COMPENSATING VALUES.

Better prices had been obtained for coke and other residuals; but it had not been possible to recoup the enormous cost of coal at its destination. This could be done only if much higher prices were obtained for gas than those now ruling. While Italy had made sacrifices in great things, it was an undisputed fact that some of the Italian municipal authorities had shown a very human desire to obtain cheap gas at the cost and loss of Italy's Allies. Whether from a fine sense of local patriotism, or the public man's wish to avoid the unpopularity of high rates, they had evinced no disposition to agree that the burden should be shared with anything like equality by the Italian consumer and the French manufacturer. He told the proprietors a year ago how the authorities at Milan had successfully delayed arbitration when time meant everything to the French Company. The tactics adopted made a dead-letter of the provision for an automatic increase in the

charge for gas in a certain ratio to the price of coal. This provision was intended not so much for the protection of either of the parties, at the expense of the other, but to secure an arrangement which would be reasonable commercially. Deprived of this protection, contrary to the letter and spirit of the contract, other methods became necessary. After prolonged negotiations, a compromise was reached, under which an increase of 12 centimes—from 13 to 25—for six months from January, 1916, and 14 centimes (to 27) from July, 1916, was agreed to. These increases at Milan virtually doubled the price at which gas had been sold prior to the arrangement. But the prices, high as they were, were still below those which would have been payable on an application of the scale based on the price of coal; and they formed an inadequate contribution to the increased cost. They represented, not profit, but reduction of loss. At Genoa the Union des Gaz was able to increase the price of gas first to 24 centimes, then to 27 centimes (the same as in Milan), in conformity with the stipulations of the existing contract—subject, however, to a question as to the extent to which further increases, although authorized by the existing contract, could be charged in so far as these were not in operation when certain maximum prices were fixed recently by an Italian Royal Decree. The rates at Milan and Genoa were not based on the prices fixed by decree for various works in Italy, and the legal position was disputed. But those at Modena (from 16 c. to 32 c.) and Alessandria (increased to 30 c.) were so fixed. Some increases in price had been obtained also in certain stations in France, during the last few months, in agreement with the authorities; and the Directors hoped for more. These increases, such as they were, helped in some way to mitigate the severity of the position; but it was impossible to place any high hopes on arrangements which might merely represent a reduction in losses.

FRENCH COMPANY'S ACCOUNTS.

Although the report of the French Company had not yet been issued, and it would not be right to anticipate its figures, it was no breach of confidence to say that the year's operations had resulted in a heavy loss, which only a strong institution, with substantial reserves, could stand. The exchange had been a source of additional loss in a Company which received its revenues in France and Italy, and had to pay in England for its coal purchases and freight.

THE STRASBOURG WORKS.

He had said nothing about the Strasbourg works, because reliable information was not available. But the Board understood generally from Paris that the interests of the Union des Gaz had been sequestrated by the German authorities.

PERSONAL MATTERS.

The shareholders would be glad to welcome back the Deputy-Chairman, Mr. Arthur Lucas, after his illness. [Hear, hear.] He was not present at the last meeting; and as it fell to his (Mr. Touche's) lot to fulfil the duties of Acting Chairman, he had asked him to continue to do so. This was why he addressed the proprietors that day in the absence of Colonel Le Roy Lewis, who was on active service. The presence in France of Colonel Le Roy Lewis had given the Directors of the French Company frequent opportunities of consultation with him. They had thus had the benefit of his thorough knowledge of the Company's affairs, and of his wide experience in the more important matters of policy, although his military duties had prevented his attendance at Board meetings. The past year had been notable in the annals of this Company, because it had marked the completion of fifty years of able, loyal, and devoted service by their friend and Secretary, Mr. Martin. [Hear, hear.] Notwithstanding this long record, he was happily still able to give valuable service. At an age when a man might reasonably seek to be relieved from the more pressing cares of business, he had laboured unceasingly with problems of unusual difficulty. He (the Chairman) had at times feared they would overtax Mr. Martin's strength; for they had been of a very worrying character, and he had never spared himself where the Company's interests were concerned. His life-long knowledge of every detail connected with the business was of exceptional value these anxious times; and he deserved all their gratitude. [Applause.]

The DEPUTY-CHAIRMAN (Mr. Arthur Lucas) seconded the motion.

Mr. C. P. CROOKENDEN asked whether, in the event of the dividend being received from the French Company, would the £26,958, which had been placed to a foreign dividends suspense account, be written-back to the profit and loss account again. Another question was as to whether, as the Chairman had told them the Directors would not in future include the dividends until they were received, the proprietors could not have the accounts made up to June 30 considerably earlier. There appeared to be no reason why the meeting should be held six months after the accounts were made up.

Mr. H. S. HARRIS asked whether in future reports a list of the Company's investments could be given. It would, he was sure, be very satisfactory to the proprietors if they knew the nature of the investments. Not only did they not know what were the holdings of the Company, but most of them did not even know where the gas was sold. They knew generally that they were doing business in Milan. They had heard that they were interested in certain other places besides Strasbourg of which the Germans were in occupation. He did not think there should be any keeping-back from the proprietors of information such as that for which he asked.

The CHAIRMAN replied that the first question put by a proprietor was one relating to the accounts; and it was raised by an expert in accounts—Mr. Crookenden. He wanted to know whether, in the event of their obtaining the sum of £29,967, the proportion which had been put to the suspense account would then be written-back. He (the Chairman) did not think he need consult their Auditors before assuring Mr. Crookenden that that would be an obvious thing to do. Then he suggested that the accounts should be submitted somewhat earlier, as, under present conditions, there was no immediate prospect of their being able to include dividends from the French Company. Of course, the Board were in the hands of the proprietors in this respect. He did not himself think that much was to be gained by having their meetings earlier, merely for the sake of submitting the accounts for about one-fifth of their business. They would not then be in a position to tell the proprietors so much as they were otherwise able to do about the general situation relating to their larger holdings. As time went on, the Directors hoped to be able to include in the accounts dividends which had actually been received from the French Company. In these circumstances, they would defeat one of the objects Mr. Crookenden had in view—that was, getting the dividend as soon as possible—if they had their meetings a long time before the French accounts could be published. He thought it would really be a greater advantage, if they made a change at all, to have the accounts brought down to a later date, seeing that no dividend was ordinarily declared by the French Company until the latter part of December. If they had their meeting in July, they would practically shut-out the results of the French Company for a year. Mr. Harris asked whether he might have some information as to where the Company's gas was consumed. He did not think Mr. Harris could have been in the habit of attending the meetings of the Company. If he had honoured them with his presence, he would have been in possession of ample information on the subject. He (the Chairman) had a clear recollection of Colonel Le Roy Lewis explaining, at one of their recent meetings, in considerable detail, what were their spheres of operation. He might assure Mr. Harris that nothing was further from the wishes of the Directors than to suppress any information on this subject. The Board wanted to tell the proprietors all they could. But he doubted whether it would be well to load their report with a geographical summary of the operations of the French Company. He (the Chairman) came to the question put as to the list of investments. Some of the Trust Companies published a list of their investments, and some did not. There were shareholders who were eager to have lists of investments published. Some Trust companies followed the middle course, and said they would not publish a list of investments; but if the proprietors cared to call at the office, they could see what they had got. In certain Trust Companies that followed this course, nobody came to inspect the lists, which showed that the desire to do so was not a consuming one. They would consider the suggestion made by Mr. Harris.

The motion was unanimously carried.

The CHAIRMAN proposed that Colonel Le Roy Lewis and Sir Henry Birchenough be re-elected Directors of the Company. They were, he said, both old Directors; and both had served the Company admirably for many years. Both had occupied the chair with distinction in past years. Colonel Le Roy Lewis was prevented from doing so at the moment owing to military duties. Sir Henry Birchenough was engaged on work of great national importance; but, fortunately, he was able to come to their Board meetings, and give them the benefit of his advice.

Sir EDWARD GOULDING, Bart., M.P., seconded the motion, which was unanimously agreed to.

It was moved by Mr. H. F. GRIMSTON, and seconded by Mr. R. STEVENS, that the Auditors (Messrs. A. T. Eastman and C. P. Crookenden, F.C.A.) be reappointed Auditors, at the joint fee of £105 per annum.

The CHAIRMAN remarked that before the proprietors parted, it was only proper that he should ask them to pass a vote of thanks to Mr. Martin (their Secretary), Mr. Bode, Mr. Nops, and the other members of the staff. They had had a great deal of difficult work to do during the past year; and it would have been impossible for the Board to have dealt with the many questions that had arisen as satisfactorily as they had been dealt with—perhaps he should rather say that the results, discouraging as they were, would have been even more unsatisfactory—if the Company had not had the benefit of the able and devoted services of the gentlemen he had named. The Directors all greatly appreciated the way in which they had served the Company during the most difficult year perhaps in the Company's history; and it would greatly encourage them to know that the proprietors shared this feeling of appreciation. [Hear, hear.]

Mr. A. F. PHILLIPS seconded the motion, which was heartily passed.

On the motion of Mr. CROOKENDEN, seconded by Mr. BERNARD F. HARRIS, a cordial vote of thanks was also passed to the Chairman and Directors, which was duly acknowledged.

ECONOMIC UTILIZATION OF COAL.

Third Howard Lecture at the Royal Society of Arts.

The series of three Howard lectures* on this subject by Professor J. S. Brame was concluded at the Royal Society of Arts on Monday of last week.

The lecturer devoted himself entirely to a discusion of the possibilities of economy in large-scale operations, and in this connection drew particular attention to the advantages of gasifying all fuel. Of the 60 million tons of coal used for power purposes, less than 10 per cent. of it was returned in available heat; and it was by gasification that the best thermal efficiency was obtained. He showed how the over-all efficiency of different gas plants varied from 22 to 27 per cent., while the reciprocating steam-engine had an efficiency of only 5 per cent., the small turbine 12 to 15 per cent., and the large turbine 15 per cent.

Gaseous fuel was the sheet-anchor on which the Royal Commission fastened as likely to produce the best economy; and the difficulties in constructing large gas-engines had hindered progress in the direction anticipated. Thus, it was that large gas plants were not being put down for gasification simply to use the gas for power purposes. On the other hand, coal gas was being used to an increasing extent for industrial operations; and in some industrial centres the price of it was down to as low as 11d. per 1000 cubic feet. One very interesting case of the adoption of coal gas for industrial heating was at the Royal Mint, where at one time all the bullion was melted down in coke-fired furnaces. It was felt that some change was desirable;

* The two previous lectures were noticed in the "JOURNAL" for Dec. 5 and 12, pp. 501, 553.

and after experimenting with various forms of melting furnaces, coal gas was finally adopted, and a large number of furnaces have been installed. Coal gas was also making great headway for domestic heating, notwithstanding that improvements were being made in the efficiency of the coal-fire. Nevertheless, it could not yet hold its own with the modern gas-fire, with its efficiency of 70 per cent. and over.

The most prodigal waste of fuel was in the large industrial operations; and the lecturer showed the nature of the waste which goes on with the "beehive" type of coke-oven. With the regenerative system, however, the bulk of the waste heat is made use of, and the resultant gas employed in one or two instances in this country to supplement the supply of coal gas for ordinary purposes. At Leeds recently, such an arrangement had been made for the supply of a million cubic feet per day, which was under one-fifteenth of the total output of the gas-works. This led to the question of pooling various waste-heat works in different parts of the country; and an outline was given of the development of the North-East Coast electric power scheme, which makes use of such waste-heat stations.

London was the only highly populated area in the country not situated in close proximity to the large coalfields, and therefore suffered in this connection. There was practically no available waste heat, and no large industries demanding power, although the aggregate was very great. Nevertheless, he thought the unification of London's electric supply would be carried out mainly by large power stations on the river below London; and efforts should be made to bring into the scheme the various gas-works, which would become supplementary feeders, through their surplus coke and future low-temperature plants, whose rich gas, after stripping for benzol, would be available for power production. Under such schemes room must be found for the coal-gas industry, which was too extensive and economically sound to be left out. The electrical engineer in this case wanted it rather too much his own way. There was good ground for working coal gas into any such scheme, as the use of gas for steam-raising opened up possibilities of too many economies for fuel production to be left out of consideration altogether. Gas could not be distributed over long distances as could electricity; but it could be concentrated at large electricity generating works to generate steam. A considerable amount of the coke produced could also be gasified. Indeed, it would probably be through the medium of the coke from existing gas-works that the gas industry would link-up with the electric power industry, because he calculated that, of the 17 million tons of coal carbonized for gas-making purposes, some 65 per cent. remained as coke, equivalent to 11 million tons. This could be gasified and used for steam-raising purposes, because in this class of coke there was very frequently as much as 70 per cent. of the nitrogen originally present in the coal. The gasification of this coke would convert the nitrogen into sulphate of ammonia; whereas if the coke was used simply as fuel under the boilers, this nitrogen would be lost.

In regard to low-temperature carbonization, it was fairly generally admitted that with a little more experience a very satisfactory smokeless fuel would be obtained for domestic use; and, if so, the quantity of coal used now for domestic purposes, to the extent of about 35 million tons per annum, would be very appreciably reduced. In fact, it was hoped that by low-temperature coke and gas-fires it would practically become a thing of the past to use raw coal in the domestic fire. In connection with low-temperature distillation, however, one of the great difficulties generally overlooked was the question of tar. At present there were plenty of outlets for the tar which resulted from coal-gas making and coke-oven plants; but the possibility after the war of over-production of tar must be realized. Chemists generally looked upon tar with great admiration. It was a material which produced most valuable products; but there was a limit to the outlet for the tar made in this way. At present 1½ million tons of tar were produced. With the conversion of the wasteful coke-ovens into regenerative plants another 350,000 tons of tar would be produced annually; and unless a profitable outlet for this could be found, a great deal of it must be used as fuel. Indeed, he was inclined to think it would be the tar produced by low-temperature carbonization which would more particularly prove itself suitable for use as a fuel tar, while for the benzol, toluol, and phenol, &c. (for which there was a large demand for specialized chemical industries), reliance would still be placed upon high-temperature tars.

PRESS VISIT TO THE UNIVERSITIES OF LIVERPOOL AND MANCHESTER.

The third of the series of visits to educational centres arranged through the "Circle of Scientific, Technical, and Trade Journalists" took place on the 10th to the 13th inst., when a party of journalists were the guests of the Universities of Liverpool and Manchester.

At Liverpool the party were received by Professor Gonner, the Deputy Chairman of Senate, in the absence of the Vice-Chancellor through indisposition. Professor Herdman gave an address on the work of the University; and subsequently the party visited the engineering section of the University.

At the Midland Hotel a reception was arranged, at which Sir Henry Miers, the Vice-Chancellor of the University, and Professor Harold B. Dixon were present. On Tuesday morning, Sir Henry Miers addressed the visitors, explaining in detail the nature of the work carried on, and how the University had developed from the original Owens College, now forming part of the federal Victoria University. The party then made a rapid tour of the very extensive University buildings—passing in turn through the engineering, chemical, medical, and other departments, and finally visiting the museum. A short lecture was delivered by Professor Dixon, who discussed the structure of flames and explained, by the aid of special photographs, the character of the flame formed when an explosion takes place. Several experiments illustrating the nature of explosives were also shown. In the adjacent laboratories tests on "T.N.T." and other explosive substances were being conducted, also experiments checking the production of toluene from distillates from neighbouring gas-works.

For luncheon, the party were entertained by the Mayor of Manchester, who gave a short address, to which Mr. Gaster replied for the visitors. Principal Maxwell Garnett read a brief account of the work at the Municipal School of Technology, which was visited in the afternoon. Here there are many different departments, of which it was only possible to get a very general impression in the time available. In the basement the visitors were shown experiments in progress on a new type of gas-heated furnace for steel tempering, with which some fine results have already been secured. It was stated that additions are contemplated to the extensive technical equipment, which will include a section specially devoted to gas-engines.

In the evening a reception was given to the visitors at the University, when the view generally expressed was that closer co-operation between the Universities and the Technical Press would be most helpful in bringing about a more general recognition of the value of the work being done by the Universities, and encouraging the fuller utilization of research by the manufacturers of the country.

Wednesday was devoted to visits to the works of the British Westinghouse Electric and Manufacturing Company and the Ford Motor Company.

LEEDS UNIVERSITY LECTURES.

Department of Coal Gas and Fuel Industries, with Metallurgy.

In connection with the work of the Department, arrangements have been made by Professor John W. Cobb, B.Sc., F.I.C. (Livesey Professor), for the delivery during the second term of the session 1916-17 of the following special courses of lectures, open to all persons engaged in any branch of the industries concerned.

I.—THE SCIENTIFIC UTILIZATION OF FUEL.

A series of six lectures on this subject will be given by Professor Cobb on Wednesdays at 6 p.m. and 8 p.m. during the second term, commencing Jan. 31, 1917, and concluding Feb. 14. Fee for the course, 10s. 6d.

First principles and the measurement of heat and temperature. Combustion in air or steam. Gas producer practice. Carbonization. Steam raising, furnaces in general, and heat efficiency.

II.—THE WASHING OF TOWN GAS WITH OIL OR TAR.

Two lectures will be given by Mr. A. Edwards, Chief Chemist to the Leeds Corporation Gas Department, at 6 p.m. and 8 p.m. on Wednesday, Feb. 21, 1917. Fee for the two lectures, 5s.

Theoretical considerations. Choice of wash-oil and washers. The washing process. Debenzolization of the enriched oil. Rectification of crude benzol. Tar washing. Analytical control. Influence of washing on candle power and calorific value of gas and on the deposition of naphthalene in mains.

III.—BYE-PRODUCT COKING PROCESSES.

A course of eight lectures by Mr. W. Greaves, F.I.C., of Leeds, will be given on Tuesdays at 6 p.m. and 8 p.m., commencing Tuesday, Jan. 30, 1917, and concluding on Feb. 20. Fee for the course, 15s.

The lectures will comprise an outline of the chemical aspects of dry distillation, with special reference to the carbonization of coal. Description of the development of bye-product coking, with its accessory processes. Manufacture of sulphate and chloride of ammonia, concentrated ammonia liquor, the recovery of benzene and toluene, cyanogen, and sulphuretted hydrogen, tar distillation, and the manufacture of tar macadam. The utilization of coke-oven gas for town lighting, power, and for the production of lamp black. Technical discussion of the various types of modern coking installations. The control of such plants, and the examination of coking coals.

Each lecture will be followed by a tutorial discussion on the scientific control of a bye-product coking plant.

IV.—EVENING LABORATORY COURSE.

The laboratory of the Department will be open on Wednesday evenings between 6 p.m. and 9 p.m. from Jan. 24, 1917, to Feb. 28, for a limited number of students who have already received some chemical training, but who desire some instruction in fuel and metallurgical laboratory methods. The estimation of benzene and toluene in tar, oil and gas will be included. Fee 10s. 6d., together with a deposit (returnable) of 10s. to cover breakages. The earliest possible application from intending students is requested.

V.—DAY LECTURE COURSES, 1916-17.

For information respecting the day lecture courses in the Coal Gas and Fuel Industries Department of the University—namely, chemistry of gases, technology of fuel, gas-producer practice, general and non-ferrous metallurgy, blast-furnace practice, iron and steel, alloys and metallography—see the special prospectus of the Department, obtainable on application to the Secretary.

VI.—ADMISSION OF STUDENTS, INQUIRIES, &c.

Intending students are requested to send in their names without delay to the Secretary of the University, specifying at the same time what course or courses they wish to attend. Other inquiries regarding the courses should be addressed to Professor Cobb, the Head of the Department of Coal Gas and Fuel Industries.

The University reserves the right to decide that any course shall not be given if the number of entries is inadequate, or if the technical services of the Department are further requisitioned for national purposes.

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SKEGNESS GAS-WORKS PURCHASE ARBITRATION.

At the Surveyors' Institution last Tuesday, the arbitration proceedings to settle the price which the Skegness Urban District Council are to pay for the undertaking of the Skegness Gas Company were begun. The matter occupied the whole week, and concluded yesterday.

The Umpire was Sir RYLAND ADKINS, M.P., with whom were sitting Mr. E. HERBERT STEVENSON for the Council and Mr. HENRY WOODALL for the Company. The Counsel engaged in the case were Mr. HONORATUS LLOYD, K.C., and Mr. KEEN for the Company, and Mr. WEDDERBURN, K.C., and Mr. G. W. BAILEY for the Council.

Mr. LLOYD said the arbitration took place in accordance with the Skegness Urban District Council Act of 1915, under which the Council put into effect their powers to purchase the Company's undertaking under an Act passed the previous year. The history of the parliamentary proceedings was that in 1914 both the Company and the Council introduced Bills. The Company decided to convert themselves into a sliding scale undertaking. Their Bill was passed. The Council asked for various powers—including compulsory power to purchase the Gas Company's undertaking. Eventually the Council secured power to come to Parliament within twelve months with a Bill definitely proposing purchase. This was done, and compulsory purchase powers were secured in 1915. The conditions of the purchase, however, were that the Company's undertaking was to be purchased upon the basis of a maximum dividend company, and not as a sliding-scale concern—in other words, neither the Council nor the Company could secure any benefit that might accrue from the change of status of the Company under their Act of 1914. Briefly indicating the growth of the Company, Counsel said it was started as a limited liability concern in 1877, and continued as such until 1902, when it was placed upon a statutory basis—having obtained a Provisional Order. The Company then supplied 14-candle power gas, and had a maximum price of 5s. 3d. The original capital was £6300 of 10 per cent. stock; but in 1907 an additional £17,000 of 7 per cent, stock was granted—making a total of £23,000, in addition to borrowing powers of £6750, or an aggregate of £29,750. Just prior to the session of 1914, there had been a period of some tension between the Council and the Company, during which the Company was taken to the Quarter Sessions for supplying inferior gas. But the case was dismissed. The Council also complained that the Company had not erected a testing-station, notwithstanding that the Council itself had never asked for a test to be made. However, testing apparatus was installed, and the gas was found to come up to standard. When, however, in 1914, the Council went to Parliament for purchase powers, the whole case was that there had been gross mismanagement; and the Company, while denying gross mismanagement, admitted that there had been some mismanagement, but claimed that things were then improving. For instance, it was stated that whereas the Company only obtained a sale of 9631 cubic feet of gas per ton of coal carbonized, it should get at least 10,500 cubic feet; also that the returns from residuals ought to be much higher than they were. Nevertheless the Company had continued to pay maximum dividends; and upon this was based the argument that the interests of the shareholders had always been placed before those of the consumers. In other words, if the Company had not been merely content while able to pay maximum dividends, they could have materially improved the efficiency of the works, and reduced the price of gas to the consumers. In putting their case in favour of purchase, the Council went so far as to say that the shareholders were so assured of their dividends that an arbitration would merely have to determine the number of years' purchase of the maintainable revenue. The Company were prepared to adopt this point of view; but the first thing to determine was the year which was to be taken for the purpose of fixing this maintainable revenue. Ordinarily, of course, 1915 would have been taken; but it was obviously common ground that 1915 was by no means a normal year. The only fair course, it seemed to him, was to take the last pre-war year, and to make the necessary adjustments for the future, having regard to the efficiency which the works might be expected to attain. In 1913, the gross profit was £1753; but adjustments would be necessary both ways. In the first place, the amount spent on repairs in that year was 5 23d. per 1000 cubic feet. To that, he admitted something should be added; and experience seemed to point to 6½d. being the most correct figure. In that respect, therefore, a deduction of £145 3s. 10d. would have to be made. Next, the works were on a leasehold site; but the purchase was to be made on the basis of a freehold site. In order to provide the necessary interest on the capital, £62 13s. 7d would also have to be deducted—making a total of £207 17s. 5d., and reducing the gross profit for 1913 to £1545 2s. 7d. These were the only two deductions which, in the Company's view, could be made. Additions would have to be made on several heads.

Mr. STEVENSON suggested that the value of the undertaking could only be what it produced with the present management and not what it might produce with greater skill in handling.

Mr. LLOYD said he would at once ask for a special case to be stated if any such view were put forward. The whole case in Parliament was that the works were capable of much better results; and the undertaking was therefore worth that much more to a purchaser. It was equivalent to a landowner having land let at an admittedly low price, and being compelled to sell the land at that price irrespective of the actual value. It could not be said that the value of the undertaking was less because it had been badly managed. The additions to the revenue of 1913 were under several heads. The Council had made a strong case in Parliament that there should be savings in coal, and a greater percentage of the cost of coal returned by way of residuals. Therefore, for the difference between the present sale of gas per ton of coal carbonized and the 10,500 cubic feet which the Company said could be obtained, he added £235; and as the Company also claimed that the return from residuals should be and would have been but for the war 55 per cent. of the cost of the coal, a further £119 was added on that account—bringing the actual net revenue for 1913 to just under £1900. The interest on the £15,000 loan obtained for carrying on the works until the transfer, amounting to £196, was deducted—leaving £1703; and this amount as the adjusted revenue of 1913 would provide sufficient to pay the maximum dividend, and at the same time leave a balance of £184. This gave the revenue as it would have stood with reasonable management in 1913; and there now remained the question of taking into account the position as it would have been in 1915, without the war—that being the year which would have been taken in the ordinary course of events. First came the question of the probable increase in sales of gas. For previous years, it was clear that this was 12½ per cent. compound; and he was going to adopt this figure notwithstanding that the actual rate of increase for the first half of 1914, up to the war, was 17 per cent. This addition, and deducting the interest on the loan for the year, increased the revenue to £1986, and would be sufficient to pay maximum dividends and leave a balance of £421. These were the whole of the adjustments from the point of revenue. Then there remained the question of the number of years by which the maintainable revenue should be multiplied. Unfortunately, the war introduced complications here, because the Act said that no money was to be raised for the purpose of the purchase during the war, and for twelve months afterwards, without the sanction of the Treasury; and as it was pretty clear that the Treasury would not give consent, it did not seem likely that the shareholders would get their money for a considerable time. In the ordinary way, it was the custom in these arbitrations to award the shareholders such a sum as, if invested in similar stock, would secure a similar return. This was all right in peace time, when the money was going to be paid; but here it was not going to be paid for some time, and although the Act of 1915 said that 5 per cent. interest was to be paid on the purchase money until it was paid, nevertheless the shareholders could not invest their money for some time ahead, and during this time they had to run the risk of all the fluctuations of the Money Market. This obviously must affect the number of years by which the maintainable revenue was to be multiplied; and something must be paid for the risk so run. As a matter of fact, there had been one arbitration concluded under similar conditions to this; and there the course adopted was to add another 2·2 years to the purchase price, irrespective of the interest on the money until it was paid, which were, he contended, two distinct questions. In the Skegness case, in order to enable the shareholders to secure a similar return, it would be necessary to adopt as a multiplier 20 years for what he would call a cash purchase, or 22·2 years for a credit purchase. In the case he had already mentioned, the arbitrators made an alternative award; and he was quite willing that this should be done here.

Mr. WEDDERBURN remarked that he should argue that the arbitrator had no power to make such an alternative award.

Mr. LLOYD said the Council desired to take possession of the works; and the Company had no objection. The negotiations hitherto had gone on the basis that the Council were going to take possession immediately the price was fixed. If the Council now argued that an alternative award could not be made, then he should raise the point as to whether the Council were entitled to possession until the money was actually paid. He was not at all clear, from the reading of the Act, that they were. Concluding his opening speech, Counsel said that to the amount arrived at by the adoption of 20 years for cash or 22·2 years for credit must be added something for compulsory purchase (for which 10 per cent. was now usual) and £1539 the amount of the back-dividends. This gave the Company's claim, on the basis of a credit transaction—viz., using a multiplier of 22·2—of £39,798.

The witnesses for the Company were Mr. William Cash, Mr. J. H. Brearley, Mr. R. G. Shadbolt, and Mr. E. J. Brockway, all of whom had prepared numerous tables upon which Mr. Lloyd had made his opening speech. Some points from the evidence and cross-examination of these witnesses are summarized below.

There was much controversy as to the addition for repairs, and the adoption of the figure of 6½d. per 1000 cubic feet. Mr. Wedderburn pointed to large numbers of undertakings where a much higher amount is allowed; but it was urged in reply that the recognized lists of statistics of gas undertakings, upon which Mr. Wedderburn relied, did not contain a single undertaking so small as Skegness, and that the majority of the larger undertakings had a considerable amount of labour-saving machinery. Thus while perhaps the amount spent on repairs and maintenance was much higher than in smaller undertakings, the labour costs were much lower. All the witnesses were agreed that 6½d. is ample in an undertaking like Skegness.

A considerable amount of cross-examination was directed to showing that if the Company continued after the war as a sliding-scale concern, the effects of the war would have materially affected its prospects for many years. Yet the Company had taken the last pre-war year and stereotyped it, making no allowance for a reduction in earnings. It was pointed out that there had been a serious diminution in the revenue; and that in 1915 only 1 per cent. dividend had been paid on the converted capital.

The sum of the answers on this point was that there will be a rapid recovery. It was said that the Company is being purchased as a maximum dividend concern, and that, having a high maximum price, it would be less likely to be affected by war conditions than a sliding-scale undertaking.

The UMPIRE asked Mr. Cash whether it was fair to stereotype 1913 in the way the Company had done, having regard to the possible effects of the war.

Witness replied that the necessity for restricting municipal expenditure after the war would be just as great as now. Consequently, this could not be regarded as deterring people from returning to Skegness and assisting it to regain its former prosperity in a very short space of time.

None of the witnesses regarded the effect of the Daylight Saving Act as serious, nor as a factor to be taken into account in affecting the price of gas undertakings in the future. Neither was it considered likely that the price of coal would increase when the present conditions no longer existed; the unanimous feeling being that the Coal Price Limitation Act has at present had very little, if any, effect upon the price of coal. If coalowners did not get the price they required, they just withheld supplies.

Mr. *Brearley* put in a structural valuation of the works; but there was no cross-examination on it.

Mr. WEDDERBURN challenged the right of the Company to pay back-

dividends. His point was that the Company is now a sliding-scale concern and lost all right to back-dividends on the conversion, notwithstanding that, under the Act of 1915, the purchase is to take place on the basis of a maximum price company. He also commented, during his questions, that, whereas when before Parliament, the Company disputed that there had been bad management, they now desired to make bad management the basis of their case, in order to show that the undertaking was worth more than it really is.

Mr. LLOYD replied that the Company had always admitted some bad management. On the other hand, the Council in Parliament based the whole of their case on the ground that the Company was badly managed, and ought to be bought up in the interests of the town. Now, apparently, it was desired to argue that the Company was well-managed. The witnesses before Parliament went so far as to say that the results obtained were shocking and scandalous. Without wishing in any way to do the present Manager an injustice, his case was that the results at Skegness could be considerably improved. As a matter of fact, they were improving until the war broke out; and it was clear that Mr, Salmon, the Manager, had never had a chance to show what the works could do.

Mr. STEVENSON put a number of questions as to why no allowance had been made, in the Company's valuation, for the effect of the war, except so far as the number of years' purchase was concerned. The answer was that as a maximum dividend company there was much less prospect of such an effect than with a sliding-scale company.

Mr. *Brockway*, who is Consulting Engineer to the Company, said the works were easily capable of producing a sale of 10,500 cubic feet of gas per ton of coal carbonized, and 55 per cent. of the cost of the coal in residuals. At Cleethorpes the return was between 65 and 70 per cent. As to repairs, from his knowledge of the substantial character of the mains and plant, he regarded 6½d. as more than sufficient, as an average. The main reason why the works had not continued to progress since 1914 was the dearth of skilled labour. This had had a very marked effect on the results.

The case for the Company closed on Friday.

Local witnesses were first called for the Council. These included the Chairman of the Council, the Chairman of the Gas Committee, the Town Clerk, and the Borough Surveyor. The purport of the evidence of these gentlemen, as well as that of a number of residents, was that the effect of the war on Skegness will be of a prolonged character. The length of time during which these effects will last, however, varied from 5 to 20 years—the idea being to show that the Company if it continued could not hope to maintain its pre-war position. The Chairman of the Gas Committee admitted that, in his personal opinion, the Council would be best now without the gas-works, as circumstances had changed so considerably since 1914, when the Council first came to Parliament, and when nobody thought the war would continue as long as it had done.

The Council's technical witnesses were Mr. W. B. Keen, Mr. Frank Jones, and Mr. J. Ferguson Bell.

Mr. *Keen* drew attention to the fact that the Company is now using coal contracted for before the war; and in adjusting the 1913 figures for 1915, no allowance had been made for the war prices which must be paid in the future. There must also be an adjustment for rates and taxes, which must inevitably be higher in the future. The result of the past five years' working was that the Company, in order to maintain maximum dividends, had wiped-out a reserve fund of £800, and for 1915 were only able to pay 1 per cent. on their converted capital. In other words, the Company were £900 worse off at the end of the five years than at the beginning. Similarly, the sale of gas in the last five years had not shown a progressive increase; yet Mr. Lloyd had taken 12½ per cent. for the future as the increase in sales and applied this figure to the increase of profits. This was entirely fallacious. The increase in the maintainable revenue could not be the same as the increase in sales. As a matter of fact, the increase in the net profit was only 7 per cent., but he hesitated to assume even this figure for the future, having regard to the effects of the war which must be taken into account. As to the effect of the war on the value of money, it was very difficult to put it into figures; but on the whole he thought that first-class gas securities should produce an additional 1 per cent. in the future. Thus an ordinary 6 per cent. investment should now return 7 per cent. He also thought the Company's revenue would be adversely affected by the higher cost of labour and materials—to some extent permanently.

Mr. WOODALL: Do you think it will affect the dividends of a maximum price company?

Witness: It depends very much on the company as to the margin there is.

There is a very considerable margin here? – Yes, there is.

Mr. *Keen*, continuing his evidence, said that the addition of the 2·2 years of credit, as suggested by the Company, amounted to an additional £3800; and in his opinion it was equivalent to paying interest on the purchase money twice over. Then there was the question of the loan of £15,000 on the undertaking. This must be taken off the purchase price. Summing up his tables, Mr. Keen said that the maintainable revenue was only £1200, as against the Company's claim of £1986. This £1200 he multiplied by 16 years, as representing the 6¼ per cent. table—making £19,200, from which he deducted the £15,000 loan, leaving the sum payable as purchase price £4200.

Mr. LLOYD cross-examined on the question of the management; and witness agreed that, looking at the accounts for a number of years past, there was evidence of bad management. In saying, however, before Parliament that the undertaking was capable of improvement, he expected that some improvement would be shown before the Council took over the undertaking; but between 1913 and now there had been no improvement.

Answering Mr. WOODALL,

Witness said that sufficient had not been allowed by the Company for depreciation; but it was possible that money had been spent out of revenue on capital purposes, and so the assets might have been improved in that way.

Mr. *Frank Jones*, who has advised the Skegness Council on the gas question from the commencement, dealt in some detail with the question of the allowance for repairs and maintenance. In his opinion, 9d. was the minimum figure which should be allowed. No company was entitled to pay dividends unless the amount was set aside. For works, 4½d. would be right; and as a matter of fact the Company did allow 4·35d. Taking the total, the Council claimed 1½d. more on works than was suggested by Mr. Brearley, ¾d. on mains, and ¼d. on stores. He entirely disagreed with the argument that a seaside works cost less to maintain than an inland works. The results suggested as possible in the working of the undertaking by the Company would never be obtained under the old *régime*. The manager could not necessarily be a great expert, as the salary paid was low. To get better results, there must be rearrangement of the retorts and in the management. During a period when the price of residuals had never been better, the Company had done no better than before. The return from residuals in 1914-15 was only 34 per cent., and he was quite sure that a 55 per cent. return from residuals would never be obtained under present conditions. The price asked by the Company on the sale of 27,000,000 cubic feet of gas in 1913 was about £2000 per million, whereas in an undertaking recently transferred under similar conditions it was very much less.

Mr. LLOYD objected to the details being given.

The UMPIRE upheld the objection.

Cross-examined, Mr. Jones said that the works ought to be able to obtain a sale of 11,000 cubic feet per ton of coal carbonized, assuming that the mains were in order and there was not the large leakage there was to-day. It might be that the Council would need to have a very much more expensive management, and so get better results. All he could say was that since 1913 the Company had not improved; and for this reason he made no allowance for prospective increase. The Company had had one of the biggest set-backs of any company he knew; and that must be taken into account in settling the price.

Mr. *J. Ferguson Bell* gave similar evidence, and added that nothing was allowed by the Council's advisers for compulsory purchase—that being left to the tribunal to decide.

The hearing of the arbitration concluded yesterday.

Mr. *C. F. Spencer*, an accountant, spoke as to the prospects of the rate of interest for borrowed money after the war being very high. Skegness could not raise a loan at 6 per cent.; and after the war 7 per cent. would probably be the lowest rate. Similarly the Skegness Gas Company's shareholders would be able to invest their money at that rate. This must have an influence on the number of years' purchase of the Company's maintainable revenue; and a liberal multiplier would be 15 years.

Mr. WEDDERBURN, speaking on behalf of the Council, said the Company had to be purchased subject to its capital liability at the date of transfer, with three additions—viz., the cost of the Company's opposition to the Council's Act of 1915, the cost of the arbitration, and up to £100 for winding up. The Company claimed the costs of their Act of 1914, which could not be allowed; but there was the question of something for compulsory purchase if the Arbitrators thought fit. As to payment of the purchase money, the 5 per cent. interest provided for by the Act covered the period during which the money was not paid, and had nothing to do with the number of years' purchase. A claim had been made on this ground for an extra number of years' purchase and also for back-dividends; but he contended that the Arbitrators could not make an alternative award. If this were done, he asked that it should be made in the form of a special case. The point had been taken on the other side that possession of the works could not be had until the money was paid; but this must be a matter for the Courts hereafter. Discussing financial policy, Counsel argued that there had been much expenditure out of capital which should have been met out of revenue; and to that extent the maximum dividends had been paid out of capital. The details of the valuations of the works on either side were then gone through; and the case for the Company that the undertaking was worth more than the figures showed because there had been incompetent management was, said Mr. Wedderburn, a remarkable argument. The future efficiency could only be based upon what had been done in the past; yet the Company claimed more than £7000 in respect of possible improvements in working in the future and £9660 for possible growth. The effect of the war would be to more than wipe-out the ordinary progress of the undertaking and also to increase the value of money, so that the shareholders could invest at a higher rate than would have been possible without the war. In other words, the number of years purchase was purely a question of the value of money, which was high.

Mr. LLOYD, in his reply, claimed that the value of the undertaking should be on the basis of a statutory maximum undertaking without any advantages or disadvantages arising out of the conversion of the Company to a sliding-scale concern. From the case for the other side, it rather appeared that the Council felt they were entering into a bad bargain because of the war; but without denying that Skegness had been badly hit by the war, anything of this description was totally irrelevant to the question before the Arbitrators. The value of the undertaking must be the value it would be to the purchaser; and clearly better results could be obtained in the future. If the Arbitrators felt they could not take this into account, then he would ask that the point be dealt with in the award in the form of a special case.

The award will be issued in due course. The Arbitrators have until Dec. 31 in which to do this.

Suicide by Gas of an Ex-Mayor of Stafford.—Mr. W. H. Peach, of the firm of Messrs. W. H. Peach and Co., shoe manufacturers, Stafford, committed suicide by inhaling gas last Sunday week. He was involved in a lawsuit in London, which came before the Court on the previous Friday, and was adjourned until Monday. On the Saturday, deceased was in an exceptionally depressed condition, and mentioned to his son that he was troubled about the result of the case. On the following morning, he left home avowedly for the purpose of attending church; and as he had not returned in the afternoon, his son went to the factory, and found him sitting in a chair in the office dead, having inhaled gas by means of a tube fixed to a bracket. Mr. Peach was a well-known public man in Stafford; and during the boom in rubber companies interested himself in the formation of some of them. He was Mayor of the borough in Queen Victoria's jubilee year.

BRITISH COALITE COMPANY.

The Present Position.

The Ordinary General Meeting of the Company was held last Tuesday, at the Liverpool Street Hotel—Mr. W. J. FISHER (the Chairman) presiding.

The CHAIRMAN, in submitting the report and accounts (which were adopted), said that for the delay in the completion of the Barnsley plant there was more than one reason to urge. The preliminary work, excavating for foundations and so on, was greatly hampered by the unfavourable weather conditions of last winter. Then all the machinery manufacturers of the country appeared to be engaged on war work; and it was only by steady persistence that they obtained some of the principal items of the plant, and this, as a rule, only a good deal later than the anticipated date of delivery. One of the most important features was the retort, for which very special fire-clay bricks were required. They began to order these bricks as long ago as July, 1915; and the bricks were still not all delivered. Another fruitful cause of delay had been the difficulty of obtaining suitable workmen. However, a few weeks, he believed, would see them through the necessity of employing the present large staff; for when the plant was at work very few men would suffice to keep it going. Their work was being watched attentively—indeed, jealously—by the interests engaged in the high-temperature distillation of coal. It was to be regretted, for the credit of British enterprise, that some of those who had been watching had not exercised greater reserve in their criticism of what the Company were doing. A little suspense of judgment would not have harmed them; and it might, incidentally, have had the effect of saving them from proving "false prophets" when the Barnsley plant showed itself the success that the Directors anticipated. Most of this unbridled and frequently ill-informed criticism came, it was true, from sources that could not be called disinterested; their sharpest critics, as he had said, having been gentlemen whose interests were bound-up in high-temperature carbonization. He thought these gentlemen would have been far better advised had they borne in mind—assuming that they were aware of them—the interesting discussions on fuel economy that took place at the meetings of the British Association at Newcastle in September last, the general sense of which was that if the nation was to derive full benefit from its wealth in bituminous coal this would have to be carbonized at low temperatures, thus effecting an enormous saving in the greatest national asset. It was precisely in this direction that the Company had been for so many years a pioneer. The Board hoped, when the nation's affairs again became normal, and acting in conjunction with others, to arrange for the erection of a large plant on the Barking land for the purpose, *inter alia*, of supplying gaseous fuel for an extensive generating station which it was intended to establish there so soon as the existing restrictions against public enterprise were removed. They were also carrying on negotiations of a similar character for the extension of the process to various parts of the country; and they had every confidence that, so soon as the Barnsley plant had proved itself, they would have requests from all over the United Kingdom for the erection of similar works. In the balance-sheet, the value of the inventions and patent rights in the United Kingdom was assessed at £160,000. This was a large sum; but he thought they must treat it as a merely hypothetical figure. It represented the value to the Company of all future concessions they might grant. Now inasmuch as they received £30,000 in ordinary shares from the Barnsley Company alone, it was obvious that when a widespread demand set in for the employment of the process, this figure might represent merely a fraction of the actual value. There had been no change in respect to the Company's property at Wednesfield. In time, no doubt, quite apart from its value as a coalfield, they would be able to find a profitable use for it. Meanwhile, most of it was let for agricultural purposes. Concerning the land at Barugh, on which the Barnsley Company's plant was being erected, this was known to be within the carboniferous area; and there had been discovered on it, more or less by accident, an extensive seam of coal, lying in no case more than a few feet below the surface. The coal was not, perhaps, of a quality that could be used in the retorts; but it had been found to be admirably adapted for use in the producers. In conclusion, he had to ask them to exercise patience a little longer; and then the Board hoped and believed their reward would be in sight.

POWER GAS CORPORATION, LIMITED.

The Sixteenth Ordinary General Meeting of the Corporation was held last Thursday, at the Offices, No. 39, Victoria Street, S.W., under the chairmanship of Mr. E. LLOYD PEASE.

The SECRETARY (Mr. Arthur G. Baker) read the notice convening the meeting, and the report of the Auditors; and the report and accounts were taken as read.

The CHAIRMAN, on rising, said he must explain that his own position there that day was quite unforeseen, and was due to the fact of the late Chairman (the Right Hon. Sir Alfred Mond) having entered the Government as First Commissioner of Works. This had necessitated the resignation of his position as Chairman and as a Director of the Corporation. The whole of the Board deeply regretted this severance of the connection of Sir Alfred Mond with the Corporation; and he felt they would wish him to express their high appreciation of the splendid services Sir Alfred had rendered to the undertaking during the last fifteen years, for eleven of which he had been Chairman. All these years he had given continued and invaluable assistance—particularly during the Corporation's years of strain, when, by his personal support, he enabled it to re-establish its financial position, so as to place it upon the sound financial and commercial basis on which it now stood. They had lost by death Mr. John Brock, one of the Vice-Chairmen for fifteen years; but they had secured an able successor to him in Mr. J. A. E. Rayner, one of the Joint-Managers of the United Alkali Company. Turning to the balance-sheet, he might point out that investments in other companies stood at £9500 more than last year; this figure representing the loan and share interest in a company which they had promoted. Contracts partly executed, less cash received on account, and sundry debtors, were £23,000 higher—due to the large amount of work in progress. On the other side, the amount of loans from bankers was considerably more than a year ago; the reason for this being again the large amount of work in hand, and also the investment already referred to. The reserve fund now stood at £18,490, as compared with £14,350 twelve months ago; and it was proposed to add to it this year the full sum allowed under the articles—£4200. This would bring the total figure to £22,690, which no doubt the shareholders would agree was a very substantial sum. The profit for the year was £21,192, which compared with £20,743. The amount brought into the accounts from the previous year was £9105, making the total sum available £30,297. Out of this it was proposed to pay away £14,977 as dividend, leaving over £15,000 to be placed to reserve and carried forward. The amount of excess profits duty (if they were liable to pay any at all) had not yet been ascertained; but the carry-forward would be considerably more than enough to meet any claim. The order-book of Messrs. Ashmore, Benson, Pease, and Co.—the Corporation's investment in which firm was of so much importance to them—was very full indeed; and it was evident that their works would be occupied to the utmost capacity for some time to come. Looking at matters all round, he believed that they had every reason to hope that the progress of the undertaking was being, and would be, fully maintained. He concluded by moving the adoption of the report and accounts, and the payment of the dividend proposed therein—namely, 6 per cent. per annum upon the ordinary shares (less income-tax).

Mr. EMILE S. MOND (the Vice-Chairman) seconded the motion, and said he would like to mention how much they owed to their staff, who, one and all, had worked with a will in face of most trying and difficult circumstances. The Chairman had just stated that the order-book of Messrs. Ashmore, Benson, Pease, and Co., was well filled; and he (the speaker) quite shared his view that they could reasonably expect another good year.

Mr. ARMITAGE said, as a shareholder, he was sure the proprietors, as well as the Directors, regretted very much the loss to the Corporation, even if it were only temporary, of Sir Alfred Mond. They owed a great deal to him; but while, as he had remarked, they regretted his loss, they were only too thankful that he had been found worthy to fill a position in what they hoped would be the Government which would very speedily end the war. The shareholders ought to be very gratified with the Company's results—not only in the past year, but the progressive results which were being experienced from year to year, and with the forecast for the year to come.

The CHAIRMAN said that, as business men, he was sure they were only too glad to see that the Government had adopted the course of putting business men in control of the country.

The report and accounts were then unanimously adopted; Mr. Pease was re-elected a Director; and the Auditors (Messrs. W. B. Peat and Co) were re-appointed.

Naphthalene Troubles at Wombwell.—Complaints were made last week, in the Wombwell District Council, about poor gas in the Hemingfield district. The Gas Manager (Mr. P. D. Walmsley), whose benzol extraction work has been the admiration of gas engineers of the North, said the trouble was due to the naphthalene in the mains, and he was experimenting with a remedy. Existing remedies, he added, did not apply to their particular case. They were always liable to this trouble; and the present operations, of course, did not mend the condition of the gas.

Nottinghamshire Gas-Workers' Wages.—Substantial increases of wages having been conceded to gas employees of the Nottingham Corporation, the movement in favour of an advance is spreading to areas beyond the county town; an example being afforded at the last meeting of the Sutton-in-Ashfield Urban District Council, when, on the presentation of the report of the Gas Committee, Mr. Spencer asked the reason for deferring the application of the men for an advance or a war bonus. It was explained that the amount of the increase so far granted to the men worked out at about 2s. a week. Sympathetic treatment was extended to the advocates of further increases in cases where the prevailing rates are low; it being promised that the matter should be dealt with by the Gas Committee at the next meeting.

Dearne Valley Water Company.—A proposal is on foot for the purchase of the Dearne Valley Water Company's undertaking in South Yorkshire, by the Hoyland Nether and the Bolton Urban Councils, and any other bodies in the area of supply who may care to join. Wombwell and Darfield are in the area; but their attitude is not very encouraging. Wombwell, in particular, is in enjoyment of rather preferential treatment at the hands of the Water Company, owing to provisions made by the founders of the undertaking, who promoted the supply largely in the interests of that place. Wombwell has a guaranteed supply at 6d. per 1000 gallons; and these terms may be bound to continue, whether or not the Council join the new scheme. This is Wombwell's contention; but the Councils concerned in the matter contest it.

An Ironmongery Trade Gas-Mantle.—A suggestion was brought forward at a meeting of the Manchester and Salford Ironmongery Trade Association, for the establishment of a trade gas-mantle. The Chairman thought that the Association were entitled to demand the supply of a standard article of British manufacture, to be sold under the trade mark of "I.F.A." throughout the kingdom. He suggested that the mark "I.F.A." should indicate quality; and one of lower quality might be sold under the designation "M.S." or "M.S.I.," to indicate the Manchester and Salford Association. One member thought the Association would be strong enough to order sufficient quantities to make the business possible; and it was agreed to approach the manufacturers on the subject. Another said he would like to see a name coined; and they might offer a prize, to get a striking and effective one. The Chairman asked members to think the whole matter over and make suggestions.

NOVEL CONSTRUCTION IN A CONCRETE RESERVOIR.

[Extracts from a Paper read by Mr. W. J. E. Binnie, B.A. (Cantab.), M.Inst.C.E., before he Institution of Water Engineers, Dec. 8.,]

Under the powers conferred by the Birkenhead Water Act, 1907, the Corporation propose to impound the waters of the Rivers Alwen and Brenig, tributaries of the Chester Dee. The scheme was laid out in two stages, the first of which involved the construction of a masonry dam on the River Alwen and an aqueduct to Birkenhead of sufficient size to deal with the anticipated yield of that drainage area only—viz., 7,200,000 gallons per diem, after allowing for the discharge of compensation water to the river amounting to 3,600,000 gallons per diem. The impounding reservoir is situated in the county of Denbigh. The total length of the aqueduct from this to the termination at the existing Flaybrick Hill reservoir of the Corporation is a little over 42 miles; and it is formed almost entirely of cast-iron and steel pipes. The Act provides for two service reservoirs of equal capacity, about 3½ miles south of Birkenhead; and the first of these (called the Cross Hill service reservoir) is now approaching completion. This forms the subject of the paper.

The top water-level of the reservoir is 232 feet above Ordnance datum; and the pipe-line is designed so as to discharge the full quantity of water from the service reservoir into the existing Flaybrick Hill reservoir. Birkenhead possesses service reservoirs having a capacity sufficient to meet the ordinary fluctuations of the demand; and therefore the chief function of the reservoir forming the subject of this paper is to provide storage in case of interruptions due to repairs being necessary on the long line of pipes, about four miles of which cross the marshes of the Dee estuary.

General Design.

The reservoir is hexagonal in plan, and has an area of approximately 3·6 acres; 1 foot in depth representing one million gallons storage. The available storage amounts to about 28 million gallons, or about four days of the anticipated supply from the drainage area. As the Alwen water is to be filtered at the upper end of the aqueduct, it was decided to cover the reservoir, so as to prevent the undesirable aquatic growths which take place when filtered water is exposed to sunlight. Advantage is taken of the fact that the reservoir is covered to reduce the cost of construction, as will presently be described. After other types of roof had been investigated, it was decided to adopt domes, supported on pillars which could be conveniently nested together by using the hexagon shape. The whole reservoir, when completed, will be covered with the excavated material; the bank being trimmed to a 2½ to 1 slope—the breadth of the banks behind the side walls at top water-level being 21 feet. Seeing the nature of the banking material, it was decided that the side walls should be so designed as to support the embankment when the reservoir is empty, and to transmit the water thrust to the embankment when the reservoir is full. The side-walls are therefore designed as a series of horizontal arches, which transmit the pressure of the embankment when the reservoir is empty to vertical plate girders, which in turn transmit the thrust to the roof and floor. There are eight of these arches in each side of the hexagon; each having a span of 30 feet, and a radius of 27 ft. 6½ in.

The floor is, generally speaking, 12 inches in thickness, resting on a foundation of hard sand. The domes are supported on 432 hexagonal pillars; and below each pillar the concrete is 2 feet in thickness—the extra foundation being hexagonal in plan.

Concrete.

All concrete was specified to be 5 to 1 concrete—*i.e.*, one volume of cement to five volumes of the aggregate of crushed stone and sand when mixed together. But the exact proportion of this was left to be determined. It was found that the stone from the adjacent Thingwall Quarry could bear a crushing stress of 400 to 500 tons per square foot. The concrete is divided into two classes: No. 1, where the maximum measurement of the broken stone was 2 inches; and No. 2, where it was ½ inch. The former was used for the floor and side-walls, and the latter for the moulded blocks, groins, and the domes. A quarry inspector was appointed by the Corporation to see that no improper stone was used. Experiments were carried out which led to the adoption of the following proportions for the materials used for the concrete which were gauged in separate boxes: For concrete No. 1, 1 part by volume of cement, 2·41 vols. of sand, and 4·16 vols. of stone; and for concrete No. 2, 1 part by volume of cement, 1·93 vols. of sand, and 3·86 vols. of stone.

The special concrete blocks were made in two ways. In one case, the moulds were placed on a "vibratory" table, the vibration being effected by means of a cam arrangement driven by a portable engine which raised one end of the table and allowed it to drop; and in the other case the moulds were themselves vibrated by a pneumatic hammer. The quality of the concrete produced by this method has been very satisfactory and uniform. It is possible to obtain equally good concrete by very careful punning; but the method here adopted ensures uniformity by mechanical means, and the "human element" is largely eliminated. In order to ascertain whether there was any appreciable difference in the quality of the concrete made by the "vibratory" method and by careful punning respectively, a series of experiments were carried out, which showed that the concrete made by the former method stood a crushing stress about 6 per cent. greater. It must be borne in mind, however, that the care taken in making experimental blocks is exceptional; and I feel confident that the actual superiority in practice is greater than appears from this result.

Floor.

As it was considered that temperature cracks were unavoidable, it was decided to cover the whole floor, when completed, with a layer of asphalte ¾ inch thick, carried under the pillars and under the side

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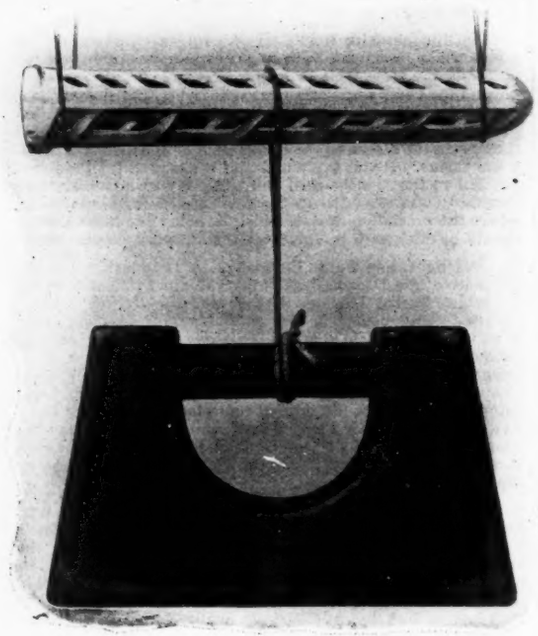

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walls so as to be continuous with a sheet of asphalte sandwiched between the brick facework and the concrete backing of the side walls. It was essential that the asphalte should not be so ductile as to spread under the weight of the pillars, or to run when placed against a vertical face; and it was decided to use Seyssel asphalte spread in two layers ¾ inch thick.

Drainage is secured by giving the floor a fall of 6 inches from the centre to circumferential dished channels having a fall of 12 inches to the inlet-well from the opposite corner of the tank. A 21-inch scour-pipe delivers the scour water into a channel formed in the bottom of the inlet-well leading to a 27-inch drain discharging into a neighbouring stream. The scour-pipe is controlled by a valve in the inlet-well.

Side Walls.

As already mentioned, the side-walls consist of a series of horizontal arches springing from steel plate girders 4 feet in depth, and 30 ft. 5¾ in. in length. The bases of these girders all rest upon concrete at a depth of 2 feet below floor-level; and each girder is connected near its upper end to the steel-angle reinforcements of the groins for the domes. These girders are surrounded by concrete at the back and special brickwork at the face; the special bricks being designed to act as springers for the arch brickwork, and to surround the flange of the girder. A space was left between the special bricks and the steel work which was filled in with Portland cement grout. The arch is of brindle brickwork set in 2 to 1 Portland cement mortar 14 inches thick to 11 ft. 3 in. above the floor-level and 9 inches thick to where it meets the domes. It is backed with concrete varying in thickness from 18 inches to 12 inches at the centre of the arch, and 5 feet at the springing where the plate girders are built in. There is a ¾-inch layer of asphalte between the brickwork and the concrete as already stated. At the centre of the arch, the concrete is further reduced in thickness by a recess which forms part of a vertical drain taking the roof drainage. This recess is arched over by a special type of cover. The side walls are not reinforced except near the top of the wall, where a longitudinal bar 2 inches by ½ inch is introduced attached to the plate girders.

Pillars.

The pillars which support the roof number 432, and are built up of moulded blocks consisting of No. 2 concrete made by the "vibratory" method. There are sixteen of these blocks, 18 inches in depth of course, in each pillar, resting on a pedestal. The pedestals are hexagonal blocks of special concrete 15 inches thickness, and 4 ft. 6½ in. between parallel sides, the top 9 inches being chamfered at an angle of 45°. Each pillar is surmounted by a moulded concrete cap 18 inches in depth, splayed at the top so as to form an abutment for the groins at right angles to the neutral axis where it meets the column. All the pillar blocks are moulded with a central circular hole 6 inches in diameter, and the blocks are dowelled together by Portland cement mortar filling this hole. The top of each column is surmounted by a steel gusset-piece to which the reinforcements of the groins are attached; and these gussets are secured to the pillars by a 1¼-inch diameter steel rod 4 ft. 6 in. in length passing down and grouted into the central hole.

Groins.

The groins which support the domes are of reinforced No. 2 concrete. They are 14 inches in width, project 14 inches below the dome, and are arched to a radius of 20 ft. 4 in. The reinforcement consists of rolled steel joists 5 ft. by 3 in. by 11 lbs. bolted to the gussets already described. The groins were constructed before the domes were commenced, and were of such a depth and so formed as to afford abutments for the domes at right angles to the neutral axis.

Domes.

The domes are of No. 2 concrete and hexagonal in plan, springing from the groins and resting on the tops of the pillars; the span from centre to centre of opposite parallel groins being 30 feet. The following points determined the design: (1) The minimum thickness of concrete to be 6 inches. (2) The line of thrust when the dome is completed and loaded to pass through the centre of thickness of concrete, so that there is no tension. (3) The extrados of the dome to be so formed that double shuttering should not be required at the springing —*i.e.*, the maximum inclination of the surface to the horizontal to be such that green concrete would stand at that angle. The second condition could not be fully met, as the loading varied according to whether the sand covering the tank was wet or dry; but the actual tension under either condition is small. The radius of the intrados of the dome varies from 50 to 17 feet as the springing is approached, and the thickness varies from 6 inches at the centre of the dome to 13 inches at the centre of the groin. It was specified that fourteen days should elapse before the centreing was struck. Each dome was completed in one operation so as to avoid planes of weakness. The intersection of the domes with the groins formed a series of zig-zag valleys into which surface drainage would find its way. These valleys were accordingly levelled-up with concrete so as to give a fall of 6 inches from the centre of the reservoir to the side wall where the drainage was delivered into the vertical pipes.

The centring for the domes, designed by the contractors, was a very workable arrangement, being easily erected and taken to pieces. Each dome centre was made up of nineteen timber segments, eighteen dome sections and a key-piece. This centre was supported on six scaffolds, triangular in plan, securely braced and mounted on wheels—one of these scaffolds being placed in position between each pair of pillars; the apices meeting at the centre of the dome. When wheeled into position, they were blocked-up from the floor and carefully levelled; the centre resting on the platform thus formed. At the expiration of fourteen days, the centre was dismantled.

Cost.

The paper also dealt with the roof drainage, access to the reservoir interior, and the inlet and outlet wells. Towards its close, the author

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stated that the contractors for the work were Messrs. R. M'Alpine and Sons. The contract was let in 1913 for £79,000, or about £2800 per million gallons of storage obtained. This compares with an average cost of £5000 per million gallons for several covered service reservoirs constructed by the London Water Companies; the economy obtained being due to the special features of the design.

Discussion.

The CHAIRMAN (Mr. A. B. E. Blackburn, of Sunderland) said the members had listened with great interest to the paper, which would form a valuable addition to their "Transactions." Some of the members inspected these works two or three months ago. The reservoir had some very striking and ingenious features. One point which struck him was as to the cost. This seemed to have come out below the actual estimate, which was rather extraordinary at a time like this, seeing that the war had supervened since the contract was let. Mr. Binnie had also drawn attention to the set-out; and the extraordinary accuracy which was attained.

Mr. C. H. PRIESTLEY (Cardiff) remarked that those of the members who had seen the work were very much impressed with the design. Mr. Binnie appeared to take it as an axiom that aquatic growths took place when filtered water was exposed to sunlight. At Cardiff they had two or three open reservoirs which contained filtered water. These had been in use from twelve to fifteen years now: and no such aquatic growth had appeared in them. Unless Mr. Binnie had special knowledge that this water would be affected in this way, he (Mr. Priestley) did not know that it was necessary that the reservoir should be covered in such an exposed position, practically free from all contamination from Birkenhead and the district. They knew that a reservoir which was not covered could be constructed at from half to three-quarters of the cost of a covered reservoir. He was pleased the concrete had stood the tests as it had done. But he had always understood that a sharp silicious sand was the best for use with concrete. The sand used in this work was, so far as he could judge, neither sharp nor silicious. In connection with the ventilation, it appeared to him that it was not sufficient. In one reservoir, he had found that, although in the first instance there were several ventilators, air collected in the top; and it was necessary to provide more ventilation in order to circulate and clear the air.

Mr. E. J. SILCOCK (Leeds) said the design of the reservoir presented many novel features; and he must say he was struck with the careful way in which the details of the design had been worked out, as well as the great care exercised in the execution. The general effect produced by the long columns, owing to the (comparatively speaking) great depth of the reservoir, was very pleasing indeed; and it gave the structure almost an ecclesiastical character, which was rather novel in an engineering design. The design reflected great credit upon Mr. Binnie; and the net result from the cost point of view was eminently satisfactory.

Mr. S. R. LOWCOCK (Westminster) observed that the extreme accuracy with which the reservoir was constructed was rather a feature for a hexagon-shaped building. It must have been set-out with extreme care to have got all the pieces of the construction to come together so correctly. He endorsed Mr. Binnie's opinion that there was a difference in strength between ordinarily-made concrete and that made by the vibratory method, and that the difference was more than 6 per cent. His experience—not on such large masses as these blocks, which were 4 ft. 6½ in. by 18 in.—was that it was much more easy to render compact a thinner slab by this means than in the ordinary way; but, on the other hand, it was much more difficult to get a good vibratory effect with a mass of concrete such as these blocks represented than with the thinner slabs such as he had experimented with. The concrete he had been using was rather "fatter" than in this case; and he found the increase in strength was from 12 to 18 per cent.—in some cases, rather more than 18 per cent.—due to the vibrating of the moulds in which the plates were cast.

Mr. PRIESTLEY asked to be allowed to further inquire whether anything was done to connect the two layers of concrete in the floor—whether they were quite separate—or whether anything was done to connect the one to the other. He had found in certain filtering-beds that the two floors were separate—not homogenous in any way.

Mr. H. ASHTON HILL (South Staffordshire Water-Works Company) said he noticed that Mr. Binnie had an inspector, or chemist, or specialist to test the concrete. He (Mr. Hill) thought this was a very proper thing to do. He had had to construct reservoirs, but had never had such an advantage. But it was a feature; and it was important the work should be done in that way. The varying conditions under which one was constructing a reservoir—varying conditions as to site and materials—had all to be considered; and the design and construction had to be suited to meet the conditions—for example, conditions such as were met with in a mining district. This reservoir struck one as being of elaborate design. It was a departure from the simple lines of the circular or rectangular structure with flat top; and one would be inclined to criticize this elaboration, if it were not disarmed by finding the cost came out so very favourably. The point mentioned by Mr. Priestley as to open reservoirs was an important one. Mr. Binnie might perhaps say something more about it. With a service reservoir, a good deal depended upon whether or not they had an independent inlet and outlet pipe. In many cases, there was only a single pipe leading in and out of the reservoir for a considerable distance from the trunk main; while there ought to be separate pipes to prevent the growth of algæ. Different waters, too, might account for it—one water might vegetate; while another water of different composition would not. Sandstone water should have covered reservoirs. He regarded the cost of the reservoir per million gallons as a very moderate one; at the same time he thought the price mentioned of £5000 for London reservoirs was rather excessive.

Mr. BAKER (Resident Engineer for the reservoir) remarked that he had got out the final figure within a few pounds for the cost of this work; and it came well within the estimate. There was a considerable length of pipe-line which had nothing at all to do with the reser-

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voir. He believed Mr. Binnie thought he should include it in his cost. The cost of the pipe-line apart from the trunk mains came to more than £2000. If they deducted this, and added any extras, they got a final cost for the tank of £73,500, which came down to nearly £2500 per million gallons, which was even better than Mr. Binnie put forward. In the design of the reservoir, they had something original, at much less cost than could have been built on the old lines. As to the roof, Mr. Binnie had, by spending money on it, obtained a cheaper job. This might sound curious; but it was a fact. As to the concrete, the whole of the roof concrete had been mixed in a Ransome mixer, driven by an 8-horse power engine. This had been a great boon to the contractors in view of the scarcity of labour. The bank was constructed entirely of sand; and it might be thought the contractors were wasteful in using carts for shifting the material. But by carting the bank was thoroughly consolidated.

Mr. C. H. ROBERTS (Aberdeen) also admired the boldness and ingenuity of the design; as well as the way in which the various problems were successfully dealt with. The capacity of the reservoir was given as 28 million gallons. This was a large size for a service reservoir, and he did not think there were many outside London so large. The aqueduct was of a sufficient size to deal with 7,200,000 gallons per day; so that there was a total storage capacity of about 35 million gallons. He took it that a proportion of the 7 million gallons was going to supply authorities on the aqueduct route. Looked at in this way he thought the reservoir was rather large. He did not know if Mr. Binnie considered the question of making the reservoir in two parts, by putting in a dividing-wall.

Mr. F. J. DIXON (Ashton-under-Lyne) asked why Mr. Binnie did not divide the reservoir in two, so as to give facilities for cleaning.

Mr. G. T. EDWARDS (Leicester) asked why Mr. Binnie adopted the old method of measuring cement by volume, and not by weight.

The CHAIRMAN said he had been very interested to hear what Mr. Baker had said as to the cost, which had come out to about £2500 per million gallons. What would have been the cost if there had been no war? Would it have come out at much less than the contract price?

Mr. BINNIE, in replying, said the cost that Mr. Baker gave was the actual, based on a contract assuming no war. They did not know that they might not be faced with claims on account of the war. It was a fact that by covering the reservoir they did not make it cost any more. If they had had no roof at the top to take the thrust of the side wall, the side wall would have had to be several feet thick at the bottom instead of only 18 inches. As to the question of aquatic growths, the filtered water would have to be stored for long periods of time; seeing that the reservoir was to be used as a stand-by in case of a break in the aqueduct. As to the sand used for the concrete, Mr. Priestley said it was not silicious. It was pure silica; and, looked at through a microscope, it was found to be fine and sharp. They did not exclude from it the fine stuff that came from the crushing. They got a high result and a better result with this sand. As to Mr. Priestley's inquiry about the floor, they did not depend upon the floor for water-tightness. The floor was simply something on which to rest the asphalte; and upon the asphalte they relied for water-tightness. As to the ventilation, they had constructed other service reservoirs with no more provision for ventilation than in this one; and there had been no trouble. As to the use of specialists, they had specialists for testing everything right from the beginning of the job. Regarding the reason for the hexagon form, a circular reservoir was a very cheap thing indeed when of a certain diameter; but when the diameter was increased, they had a great deal of crushing strain; and, in this instance, they got beyond the limit. With regard to Mr. Roberts' criticism of the large capacity of the reservoir, he explained in the paper that the chief function of the reservoir was to provide storage in case of interruptions due to repairs being necessary on the long line of pipes, about four miles of which crossed the marshes of the Dee estuary. In view of this, he had been a little nervous as to whether he really had provided sufficient storage capacity.

The Walsall Gas Poisoning Case.—Mrs. Brown, who, with her husband, was found overcome by gas fumes at their residence in Walsall, died subsequently in hospital. The man, as stated last week, was dead when the discovery was made. At the inquest on the bodies, it was stated that the gas-stove which was burning in the room had only been taken to the house the previous day; and Mrs. Brown told a friend that her husband had sent it up from the shop to warm them at night, and that he was going to fix it up himself when he had finished business. A verdict was returned that the deceased were accidentally suffocated by carbon monoxide.

Effect of Fog on Gas Consumption.—The darkness that has overspread Lancashire during the past week has had the effect of considerably increasing the consumption of gas in the principal towns and boroughs; but though big figures have been reached, very few "records" have been broken. On Monday, at Manchester, the consumption was close upon 27 million cubic feet, as against 21 millions, the normal daily consumption. The "record" for the department still rests with November, 1914, when in a single day close upon 30 millions were consumed. At Oldham, however, the consumption on Monday was the largest hitherto recorded—9,196,000 cubic feet.

Oldham Gas Committee and Land Cultivation.—At the last meeting of the Oldham Gas Committee, Mr. Arthur Andrew (the General Manager) reported that, in view of the decision of the Government to increase home-grown foodstuffs by the cultivation of land in different districts, it had been decided to pay attention to certain plots at the Higginshaw Gas-Works. The land was said to be good. Mr. T. Duxbury (the Engineer) stated that there were about 8 acres of land in the occupation of the Gas Committee suitable for the purpose. It was further reported that offers to cultivate land in the Committee's occupation would be favourably considered, if the land was utilized to the satisfaction of the department.

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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 18.

The tone of the pitch market is very firm, and fair business for export is reported at 22s. per ton net in bulk at makers' works. The creosote position is firmer, and, owing to the demand for oil fuel for home, the price has been fixed at 75s. per ton net at makers' works. Anthracene, 48-50 per cent., is 3d. per unit, casks free; and 95-160 solvent naphtha 2s. 3d. per gallon naked, both at works, net cash.

There is a growing demand for sulphate of ammonia from all sides. The price of £18 2s. 6d. per ton net into buyers' bags at makers' works has been paid for 25 per cent. quality, for prompt delivery.

Tar Products in the Provinces.

Dec. 18.

The price of pitch is unchanged. In solvent naphtha, some sales are reported at lower prices. Creosote is very firm.

The average values of gas-works products during the past week were: Gas-works coal tar, 19s. to 23s. Pitch, East Coast, 16s. to 16s. 6d. per ton; West Coast—Manchester 15s. to 15s. 6d., Liverpool 16s. to 16s. 6d., Clyde 17s. to 18s. Benzol, 90 per cent., North, 10⅜d. to 11½d.; 50 90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6¼d. to 6¾d. Solvent naphtha, naked, North, 1s. 10d. to 1s. 11d. Heavy naphtha, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 3¼d. to 3⅜d. Heavy oils, in bulk, North, 3½d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene salts, 70s. to 80s., bags included. Anthracene, "A" quality, 2¾d. to 3d. per unit; "B" quality, ¾d. to 1d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Dec.* 15.

During the past week, the strength of the market has been well sustained, and all available supplies have found a ready outlet at increasing values. Although new business with Spain has been stopped by the Board of Agriculture, the demand from other neutral countries and from British possessions has been ample to absorb the surplus production in the United Kingdom. At the close, the quotations for December are £18 10s. per ton f.o.b. Hull, £18 12s. 6d. f.o.b. Liverpool, and £18 17s. 6d. f.o.b. Leith. For January-June delivery, £18 17s. 6d. f.o.b. good port has again been paid, and for January-March £19 per ton has been reported.

Nitrate of Soda.

The market for this material has continued on its upward course, and spot values are now 19s. 6d. per cwt. for ordinary quality and 19s. 9d. for refined.

Sulphate of Ammonia.

From another source the quotations are given as follows: Outside London make, £17; Hull, £17 15s. to £17 17s. 6d.; Leith, £18 2s. 6d. to £18 5s.; Liverpool, £18 to £18 2s. 6d.; Middlesbrough, £18.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade shows a little more activity, especially in the home demand. The export trade is in some degree still interfered with by lack of ready steamers, and where this is the case, prices are irregular. In the steam coal trade, the demand is maintained. Best Northumbrians are from 30s. per ton f.o.b., second-class steams from 24s. to 26s., and steam smalls from 17s. to 20s. The latter are a little more plentiful. Production is full—as it is usually in the week before the holidays—and is taken up fairly well under current conditions. In the gas coal trade, the demand is heavy, and prices are steady, especially for early delivery. Best Durhams are from 24s. to 26s. per ton f.o.b., second-class gas coals are about 18s. 6d. to 20s., and "Wear specials" are firm at about 27s. 6d. to 31s.—the latter quality being rather scarce. The inquiry for gas coals for forward export seems to be larger; but it is rather difficult to arrange for tonnage—requirements being heavy for our Allies, at the scheduled figures. Some of the contracts that come into the market about the turn of the year should soon be given out; but these are not usually for large quantities, and the freights continue high. Production at the pits will be restricted until the year is turned; and this may allow tonnage to arrive more equal to the needs of buyers. Good gas coke is quoted from 34s. to 35s., with a full output. Coke freights to the northern ports of France are about 35s. Tyne to Dunkirk.

The Halifax Gas Committee and Mr. W. B. M'Lusky (the Engineer and Manager) last Thursday week had, as guests on a visit to the gas undertaking, the members of the Halifax Drapers' and Hosiers' Association. The party were met by Councillor J. H. Waddington (the Chairman of the Gas Committee) and Mr. M'Lusky, and conducted over the works, where the ordinary methods of gas production and the various features which have been added in recent times were inspected with great interest. Subsequently, in the Committee-room, the party were addressed by Mr. M'Lusky, who explained how consumers may get the best light with the least cost. The appreciation of the visitors was expressed in a hearty vote of thanks, moved by the President of the Association (Mr. P. M. Granger).

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Electric Light Failure at Carmarthen.—There was a failure of the electric light at Carmarthen for a couple of hours last Wednesday evening. A concert had to be postponed, and a number of other meetings could not be held, as there was no other source of light available in the halls in which they were to have been held.

Coal Stack Fire at Leeds.—Some days ago, two large stacks of coal at the New Wortley Gas-Works of the Leeds Corporation were discovered to be on fire, under circumstances which will be found explained in the account [on p. 590] of the proceedings on the occasion of the visit of the Yorkshire Junior Gas Association to the works last Saturday.

Electrical Troubles at Rochdale.—With a single dissentient, the Rochdale Town Council, at a meeting last Thursday week, passed a resolution that the Gas and Electricity Committee be instructed to report on the causes of the "unsatisfactory conditions in relation to the supply of electricity," and their proposals for meeting immediate and future demands.

Summer-Time Act Effect in Lancashire.—Many of the Lancashire municipal authorities have during the last few weeks passed resolutions favourable to the "Daylight Saving" measure introduced in the early portion of this year; and at the last meeting of the Bury Town Council, it was reported that a letter had been received from the Municipal Corporations Association regarding the matter. The Gas Committee resolved that, in their opinion, the Summer Time Act should be re-introduced, but that its operation should commence and terminate a month earlier than was the case this year.

Nottingham Gas Supply.—The Not ingham Corporation Gas Committee have been handicapped by circumstances beyond their control, in completing important works of reconstruction; and the necessity has been forced of giving notice to the public that, though there is sufficient gas for present requirements, if a larger demand is made owing to fog or very cold weather great difficulty, or even impossibility, may be found in giving an adequate supply. The public have therefore been requested, during the winter months—and especially the next four or five weeks—to be as economical as possible in the use of gas. Otherwise, it is intimated, there may be an absolute necessity to curtail the supply.

Coke for Boilers at Baths.—The Camberwell Borough Council a short time ago arranged with the South Metropolitan Gas Company for the installation at the Old Kent Road baths of a forced-draught apparatus, which permits of the consumption of coke, and also does away to a great extent with the nuisance from smoke. The apparatus has proved very satisfactory, and has effected a saving in fuel. Having received a report from the Borough Engineer upon the subject, the Baths Committee have now made arrangements for the provision of similar apparatus to two boilers with double furnaces at the Old Kent Road baths, and for five of these contrivances to be fixed to furnaces at the Church Street baths. The work of fixing will be carried out by the Gas Company; and the whole cost, including the contrivances themselves, will amount to about £79.

Gas Explosion in Cork.—Gas which had percolated from a main into two houses at St. John's Place, Cork, resulted in an explosion, damage being done in both houses. Fortunately, however, no one was injured.

Price of Gas at Kirkburton.—The Kirkburton (near Huddersfield) Gas Company have announced a revision of charges, to take effect on Jan. 1. The new rates are to be: For illuminating purposes, 4s. 2d. per 1000 cubic feet, subject to discount, if paid within two months, ranging from 5 to 12½ per cent., according to consumption. No discount is to be allowed on gas supplied by prepayment meter. The price for gas for motive power, heating, and cooking will be 3s. 4d., subject to discounts of from 5 to 10 per cent.

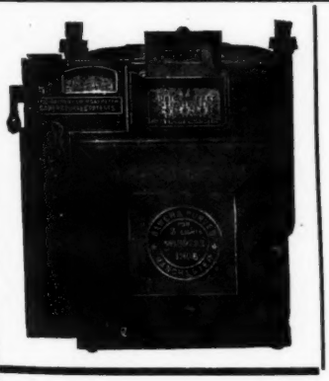
Accident at the Honley Gas-Works.—At the Honley Gas-Works, near Huddersfield, last week, a new steam motor tank, belonging to Messrs. J. & E. Morton, tar distillers, of Milnsbridge, while being driven out of the yard with a 4-ton load, was passing over the weighbridge, when the bridge gave way, and the falling mass of material cut through the 10-inch gas-main, and all local works run by gas power were stopped. The escaping gas was ignited from the fire of the motor engine. Mr. H. Marsden (the Gas Manager), however, promptly shut off the gas in the main, and the fire was soon controlled.

Fatal Acetylene Cylinder Explosion.—Three deaths and more or less serious injuries to about forty employees at Messrs. Grayson's repairing works, Liverpool, were caused by an explosion which occurred while a number of cylinders of acetylene were being unloaded from a waggon. At the inquest a large volume of evidence was tendered. One witness said they had handled the cylinder carefully; while another declared that he saw the end of one of the cylinders (he could not state which) dropped when it was about a foot from the ground. The Jury's verdict was that death was due to an explosion caused by a deficiency in the cylinder of porous material and acetone. They added a rider "that greater care should be observed in the transit of these highly explosive cylinders through the streets and generally."

A fire at the London residence of Sir Stuart Montagu Samuel, M.P., was caused by a defective electric circuit. Only slight damage was caused.

Mrs. Woods, of 3, Coningsby Street, Belfast, was found dead in her bedroom from the effects of gas poisoning; the gas in the room being turned on—whether by accident or design there was no evidence at the inquest to prove.

The Ripon City Council, in their reply to the Local Government Board circular asking for information regarding works the Corporation are likely to undertake, or consider the necessity of, after the war, include gas-works with an approximate expenditure of £10,000, and electricity works, £20,000.



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It is reported that the Marylebone Borough Council are calling a conference of local authorities to discuss the conditions of labour and rates of wages paid to employees in electricity supply undertakings, because the need for a general understanding on the wages question is becoming urgent in consequence of the frequent representations from the trade unions.

The Gas Committee of the Burton-on-Trent Town Council have considered an application from the Ironmongers and Gas-Fitters. Association, with regard to the prices to be paid for fixing gas-fires, &c. The Committee resolved that the standard price for fixing fires be increased from 11s. 9d. to 14s., from Oct. 1 last, and that arrangements be made for a revision of the schedule of prices for time and material.

STOCK MARKET REPORT.

THE week just closed on the Stock Exchange showed points of improvement over its predecessor from pretty well every line of view. To begin with, there was more business in evidence—not much, but then it did not require much to beat so stagnant a period as the week before. It was the calm hopeful tone that imparted confidence to markets in general, owing to various factors, culminating in the fine achievement of our Allies on the Verdun front on Friday. This welcome success, coming after a longish period of only minor activities, infused a spirit of great cheerfulness on the closing day. Another even more potent influence perhaps was the successful *début* of the new Government in the realms of finance. The sound and business-like utterances of Mr. Bonar Law, in his introduction of the Vote of Credit on Thursday, strengthened the faith of the City in its new rulers. It feels that its great experience, which is at the service of the Chancellor if he choose to avail himself of it, will not be spurned. At the same time, a word of recognition is due to Mr. M'Kenna for his friendly attitude. The only "fly in the ointment" last week lurked in the German Peace machinations, which caused annoyance.

The result of these factors upon markets was that the gilt-edged department made a marked improvement. War Loan and Consols both advanced, and many other issues were in good demand. Home Rails, after a poor start, finished up in buoyant style and marked good progress. Americans took a line of their own, though a little better at the close, and Canadians followed suit. The Foreign Market was for some time quite dull, except for a sharp demand for Swedish and Norwegian issues. But when the Verdun news came, things brightened at once, especially the French Loan. Argentines were better; but South Africans were dull. In the Miscellaneous group, shipping was the most noticeable, falling continuously to a point and then sharply recovering.

Business in the Gas Market was almost non-existent—probably constituting a record for paucity of business. Some Suburban and Provincial issues went at steady figures, but elsewhere the tendency was easier, though not to any marked extent. So long as this tone continues, it is only to be expected that prospective sellers will postpone operations. The Money Market was at first easy, but later there was a better demand.

Bargains done for cash during the week were as follows: On Monday, Alliance and Dublin 62¾, 63, Bombay 5½, Gas Light ordinary 69½, 70, Primitiva 40s., ditto preference 60s., 61s. 9d. On Tuesday, Brentford "A" 86½, Gas Light ordinary 69, 70, Primitiva preference 61s. 3d., South Metropolitan 80. On Wednesday, Gas Light ordinary 69, 69¾, 70. On Thursday, Brentford "B" 82, 82½, Gas Light ordinary 69, 69¾, 70, ditto maximum, 55, 56, Imperial Continental 70, Southampton 77½, 77¾, Tottenham "B" 89, 89½. On Friday, Gas Light ordinary 69, 69⅝, 69¾, 70, ditto maximum 56, 56½, South Metropolitan 79½, 79¾, 80, 80¼. On Saturday, Gas Light ordinary 69½, 69⅝, ditto preference 70, 70¼, South Metropolitan, 79½, 80.

The Bank rate is 6 per cent.—as fixed on July 13.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
175,472	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	65—70	..
1,551,868	,,	April 8	3½	5½%	Alliance & Dublin Ord.	59—64	62—64	62¾—63
274,000	,,	July 10	4	4%	Do. 4 p.c. Deb.	76—79	60—65	..
280,000	5	April 29	1½	4/6	Bombay, Ltd.	5½—6½	5—5½	5½
50,000	10	Feb. 26	16	16/-	Bournemouth Gas { 10 p.c.	29—30	25—27	..
333,110	10	,,	7	7/-	and Water { B 7 p.c.	15—15½	11—11½	..
115,000	10	,,	6	6/-	Pref. 6 p.c.	13½—14	9½—10	..
159,740	—	—	—	4%	4 p.c. Deb.	..	73—75	..
993,045	Stk.	Feb. 26	†14	55/-	Brentford A Consold.	261—266	85—87	86½
734,910	,,	,,	†11	58/9	Do. B New	204—209	83—85	82—82½
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	85—90	..
221,400	,,	June 11	4	4%	Do. 4 p.c. Deb.	91—98	67—69*	..
217,980	Stk.	Feb. 26	11	10½%	Brighton & Hove Orig.	208—218	160—165	..
344,900	,,	,,	8	7½%	Do. A Ord. Stk.	154—159	115—120	..
830,000	20	Mar. 26	12½	22/6	British	44—45	34—35	..
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	68—70	..
345,771	Stk.	June 26	4	4%	Buenos Ayres 4 p.c. Deb.	85—87	60—65	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1¼—2½	1½—1¾	..
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4—6	4½—5*	..
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	60—65	..
157,150	Stk.	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	82—83	..
1,513,280	Stk.	Feb. 19	5 9/4	49/4	Commercial 4 p.c. Stk.	106—108	72—74	..
660,000	,,	,,	5½	46/8	Do. 5 p.c. do.	103—105	68—70	..
475,000	,,	June 11	8	8%	Do. 5 p.c. Deb. Stk.	69½—71½	52—54*	..
800 000	Stk.	,,	4	—	Continental Union, Ltd.	76—79	36—38	..
900 000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	57—59	..
278,400	—	—	—	11½%	Croydon B and C 7 p.c.	..	175—185	..
—	—	—	—	10%	Do. E	..	..	..
499,370	Stk.	—	6	5½%	Derby Con. Stk.	128—135	100—105	..
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	80—83	..
1,002,180	10	July 29	10	7/6	European, Ltd.	17½—18	11½—12½	..
16,318,430	Stk.	Feb. 10	4/17/4	42/-	4 p.c. Ord.	98—102	69—71	69—70
2,600,000	,,	,,	3½	3½%	Gas Light and Coke 3½ p.c. max.	76—79	55—58	55—56½
4,069,235	,,	,,	4	4%	4 p.c. Con. Pref.	96—99	69—71	69—70½
4,674,850	,,	June 11	3	3%	3 p.c. Con. Deb.	73½—74½	51—58*	..
130,000	,,	,,	10	10%	10 p.c. Bonds	..	..	..
958,740	Stk.	Mar. 12	5	4½%	Hastings & St. L. 3½ p.c.	87—89	78—83	..
70,000	10	April 29	11	6%	Hongkong & China, Ltd.	16½—16¾	8—9	..
66,600	—	—	—	9%	Hornsey 7 p.c.	..	125—135	..
181,000	Stk.	Mar. 12	7½	7½%	Ilford A and C	151—154	112—117	..
65,780	,,	,,	6⅜	6¼%	Do. B	116—119	103—108	..
65,500	,,	June 26	4	4%	Do. 4 p.c. Deb.	92—94	73—76	..
4,940,000	Stk	May 14	9	44%	Imperial Continental	150—160	72 77	70
1,335,000	Stk	Feb. 12	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	65—67	..
235,943	Stk	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	87—92	..
2,498,905	Stk.	Feb. 26	10	8%	Liverpool 5 p.c. Ord. { A	211—213	85—87	..
					{ B	146—148		
806,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	71—76	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4½—4¾	3¾—4¼*	..
250,000	100	April 1	4½	4½%	Met. of Melbourne 4½ p.c. Deb.	99—101	89—93	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	8¼—8⅞	..
1,875,892	Stk.	July 29	4½	4½%	Newc'tle&G'tesh'd Con.	98½—99½	79—80	..
599,705	Stk.	June 26	3½	3½%	Do. 3½ p.c. Deb.	88—88	75—77	..
55,940	10	Feb. 26	7/14/0	7/8/8	North Middlesex 7 p.c.	14—15	10½—11½	..
800,000	Stk.	May 14	8	8%	Oriental, Ltd.	117—122	104—106	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7¾	2—3	..
60,000	50	Feb. 26	13	12%	Parkes, Island B	128—131	95—100	..
100,000	50	,,	12	11%	Do. C	118—121	88—93	..
52,000	50	,,	10	9%	Do. D	..	..	..
349,980	5	April 29	8	—	Primitiva Ord.	5½—6	2 2½	40/-
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4⅝—5	3 3½	60—61,9
521,600	100	June 2	4	4%	,, 4 p.c. Deb.	91—98	78—80	..
—	—	—	—	4%	,, ,, 1911	..	..	..
846,198	Stk.	June 26	4	4%	River Plate 4 p.c. Deb.	85—87	63—68	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	8—8½	..
195,000	50	July 1	5	£%	{ 5 p.c. Deb.	47—49	43—45	..
135,000	Stk.	Mar. 12	10	10%	Sheffield A	223—224	188—192	..
209,984	,,	,,	10	10%	Do. B	223—224	188—192	..
528,500	,,	,,	10	10%	Do. C	220—222	188—190	..
90,000	10	May 28	9	6/-	South African	10½—11½	..	..
6,609,895	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	80—83	79—82
1,895,445	,,	July 10	8	8%	Do. 3 p.c. Deb.	72½—74½	59—61	..
224,890	Stk.	Feb. 26	8½	8%	South Shields Con. Stk.	167—169	145—147	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	80—82	..
60,000	,,	,,	5	5%	Do. 5 p.c. Pref.	110—112	79—81	..
135,000	—	—	—	48/4	Do. West Kent.	..	..	..
187,558	,,	June 26	5	5%	Do. 5 p.c. Deb. Stk.	116—118	90—92	..
647,740	Stk.	May 14	5	5%	Southampton Ord.	99—102	77—79	77½—77½
190,000	Stk.	Feb. 12	7½	7½%	Tottenham { A 5 p.c.	185—188	120—123	..
782,375	,,	,,	6	5⅞%	District { B 3½ p.c.	116—117	90—92	89—89½
181,255	,,	June 26	4	4%	{ 4 p.c. Deb.	87—89	65—67*	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	£%	Do. 5 p.c. Deb. Red.	98—95	60—65	..
286,476	Stk.	Mar. 12	5	£%	Tynemouth, 5 p.c. max.	103½—109½	91—92	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8½	78/9	Wandsworth A 5 p.c.	151—156	117—122	..
255,686	,,	,,	6½	63/9	,, B 3½ p.c.	129—134	101—103	..
108,075	,,	,,	5/17/8	55/1½	,, C 3½ p.c.	110—115	88—93	..
852,000	,,	,,	6½	57/6	Wimbledon 5 p.c.	117—122	91—95	..
98,000	,,	,,	6½	63/9	Epsom 5 p.c.	121—126	98—103	..
98,416	,,	June 26	3	£%	3 p.c. Deb. Stk.	66—69	53—56	..

* Ex. div. † Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

GAS ENGINEER (Gas Engines and Suction Gas Plants). No. 6253.
WORKING MANAGER. No. 6249.
WORKS FOREMAN. No. 6250.
SHIFT FOREMAN. No. 6248.
GAS METER INSPECTOR. No. 6254.
FOREMAN AND TIMEKEEPER. Deal and Walmer Gas and Electricity Company.
GAS-FITTERS. Hereford Gas-Works.
WASTE WATER AND TAP INSPECTOR. Wombwell Urban District Council. Applications by June 6.
STOKER. King's Lynn Gas-Works.

Agency Wanted (France).

G. Margueritte, 20, Rue de Grammont, Paris.

Plant, &c., for Sale.

AMMONIACAL LIQUOR STILL. Robin Hood Coke Works, near Wakefield.
GASHOLDER AND TANK. ReadingGas-Works.
LIVESEY WASHERS. Bale and Hardy, 99, Victoria Street, S.W.
METERS (THREE-LIGHT). Gas Light and Coke Company, London.
PURIFIERS, BUILDING, &c. Birkenhead Gas-Works. Offers by Jan. 10.
ROTARY WASHERS. W. C. Holmes and Co., Limited, Huddersfield.

Tank Waggons Wanted (Hire or Purchase).

No. 6251.

Carbon Wanted.

No. 6192.

TENDERS FOR

Tar.

HARWICH GAS AND COKE COMPANY. Tenders by Jan. 4.

THE MITCHELL, FOR PATENT COLD METER TAR & OTHER LOCKS. KENTISH TOWN, N.W. 54 & 2396 Manchester